For Reference

NOT TO BE TAKEN FROM THIS ROOM

Ex libris
universitatis
albertaensis



The University of Alberta
Printing Department
Edmonton, Alberta

THE UNIVERSITY OF ALBERTA

UNDERSTANDING OF SPATIAL PREPOSITIONS BY CHILDREN IN KINDERGARTEN, GRADES ONE AND TWO

by

© RUBY MARY JOHNSON

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF EDUCATION

DEPARTMENT OF ELEMENTARY EDUCATION

EDMONTON, ALBERTA

FALL, 1970

Thesis
1970 F
138

UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled UNDERSTANDING OF SPATIAL PREPOSITIONS BY CHILDREN IN KINDERGARTEN, GRADES ONE AND TWO submitted by Ruby Mary Johnson in partial fulfilment of the requirements for the degree of Master of Education.

ABSTRACT

The purpose of this study was to investigate the understanding of children in kindergarten, grades one and two, of prepositions of spatial position using three modes of stimulus-response sections.

The test sample consisted of 120 children in kindergarten, grades one and two, stratified to include equal number of each grade, sex and socio-economic status group. All of the subjects were enrolled in two schools in Edmonton, Alberta. One school and one kindergarten were from a higher socio-economic area, and one school and one kindergarten from a lower socio-economic area.

A prepositions test including three subtest sections was used to measure understanding of prepositions of spatial position.

The first test section, Verbal (Oral) — Non-Verbal stimulus-response mode, was designed to measure understanding of spatial position when preposition was indicated in a sentence given orally by the investigator.

The second, Verbal (Oral) — Verbal (Oral) stimulus-response test section, measured the accuracy of terms used by subjects in identifying spatial position.

The third test section, Reading — Non-Verbal mode of stimulus-response, measured the ability of subjects to demonstrate spatial position when preposition was embedded

in a sentence read orally by subjects.

Sections one and two of the Spatial Prepositions Test were administered to the total sample and section three to grades one and two subjects only. Each subject was tested individually.

In addition, tests that measured intelligence and reading achievement were administered.

Children's test responses were subjected to statistical analysis using three-way analysis of variance, computation of correlation coefficients and a z test of difference between proportions.

Correlational analyses indicated that intelligence, reading achievement, and chronological age were significantly related to test performance. Sex and socio-economic status were not significant factors in ability to understand prepositions of spatial position.

The findings of this study revealed the progressive ability of pupils at successive grade levels to demonstrate understanding of the concept of spatial position. Children were able to demonstrate more ability in understanding the concept of spatial position in oral than in printed context and more ability was demonstrated in both of these modes than in ability to use accurately terms denoting the concept.

Educational implications for reading and suggestions for further research were presented.

ACKNOWLEDGEMENTS

The writer wishes to express grateful appreciation to Dr. J. Robertson, Chairman of the Thesis Committee, for her expert guidance and supervision throughout the study. Appreciation is also extended to the members of the Thesis Committee, Dr. M. Horowitz, Dr. M. Jenkinson, and Dr. D. Friesen, for their suggestions.

The writer is indebted to Dr. George Cathcart for his advice and assistance in setting up the statistical analyses used in the study.

Grateful acknowledgement is expressed to Mrs. Marilyn Brooks for her assistance in data collection and scoring, to Mrs. Margaret Andrews for her help in scoring, and to Mrs. Roselyne Carola for construction of the model school and playground.

Sincere thanks is also extended to the pupils who participated in this study, to the teachers and principals of the schools involved, and to the Edmonton Public School Board who made this study possible.

TABLE OF CONTENTS

	Page
CHAPTER I - THE PROBLEM	1
Introduction	1
Background of Problem	3
Summary Statement of Problem	8
The Need for this Study	8
Statement of Purpose	9
Definition of Terms	10
Hypotheses	12
Overview of the Study	13
Population and Sample Used	13
Procedure	14
Limitations of the Study	15
Significance	16
Organization of the Report	17
CHAPTER II - THEORETICAL BACKGROUND AND RELATED RESEARCH	18
Development of Spatial Concepts	19
Development of Concepts of Space	19
Development of Concept of Spatial Relations	19
Support for Theory of Developmental Sequence Concept of Space	21
Responding to Spatial Relationships	23
Section Summary	25

Page

Role of Verbalization in Concept Formation ... 25

Language and Processes of Concept Acquisition 25
Concept Development, Language and Thought 26
Language and Concept of Spatial Relationships 28
Verbal Response and Concept Understanding 34
Section Summary 36

Factors Influencing Concept Development 37

Experience 37
Summary 41
Socio-Economic Status 41
Summary 45
Chronological Age 46
Summary 48
Intelligence 49
Summary 52
Sex 53
Summary 54
Individual Differences 55
Summary 56
Materials 56
Summary 56
Section Summary 57

Role of Concepts in Reading 57

Section Summary 59

Summary of Research Studies 60

Summary of Chapter 62

CHAPTER III - THE EXPERIMENTAL DESIGN OF THE STUDY 63

Population and Sample 63

Population 63
Sample 64

Page

Instrumentation 69

Intelligence 69
Reading Achievement 71
Understanding of Prepositions of Spatial Position 72

Pilot Study 80

Model 80
Test Format 81

Data Collection 82

The Scoring 84

Verbal (Oral) — Non-Verbal Section 84
Verbal (Oral) — Verbal (Oral) Section ... 85
Reading — Non-Verbal Section 86

Statistical Analysis of Data 87

Summary 88

CHAPTER IV - ANALYSIS OF THE DATA 89

Performance of Kindergarten, Grades One and Two Subjects on Two Modes of Stimulus-Response Sections of the Spatial Prepositions Test 89

Pupil Performance by Sex 100
Pupil Performance by SES 103
Pupil Performance by Total I.Q. 105
Pupil Performance by Language I.Q. 109
Pupil Performance by Non-Language I.Q. ... 113
Pupil Performance by Chronological Age ... 116
Section Summary 119

Performance of Grades One and Two Subjects on the Third Mode of Stimulus-Response Section 121

Pupil Performance by Sex 122
Pupil Performance by SES 122
Pupil Performance by Total I.Q. 123
Pupil Performance by Language I.Q. 124
Pupil Performance by Non-Language I.Q. ... 124
Pupil Performance by Reading Achievement.. 125
Pupil Performance by Chronological Age ... 128
Section Summary 130

Page

Correlational Analyses 131

Section Summary 136

Analyses of Variance 137

Analyses of Variance on Two Modes of Stimulus-Response Sections 137
Analyses of Variance Including the Third Mode of Stimulus-Response Section .. 146
Section Summary 155

Comparison of Difficulty Level of Prepositions of Spatial Position 157

Proportion of Subjects Scoring Correct on Each Preposition Tested Between Modes of Stimulus-Response Test Sections 158

Kindergarten 160
Grade One 160
Grade Two 161
Section Summary 165

Proportion of Subjects Scoring Correct on Each Preposition Tested Within Each Mode of Stimulus-Response Section 166

Kindergarten 167
Grade One 174
Grade Two 176
Section Summary 179

Additional Findings and Test Observations 180

Summary 183

CHAPTER V - SUMMARY, CONCLUSIONS, IMPLICATIONS AND SUGGESTIONS FOR FURTHER RESEARCH .. 185

Summary of Study 185

Main Findings 187

Hypothesis 1 187
Hypothesis 2 188
Hypothesis 3 189
Hypothesis 4 189
Hypothesis 5 190
Hypothesis 6 192
Hypothesis 7 194
Hypothesis 8 194

Page

Conclusions 195

Implications for Reading 199

Suggestions for Further Research 200

Concluding Statement 202

BIBLIOGRAPHY 204

APPENDIX A - EXAMPLES OF SELECTED OBJECTS USED IN SPATIAL PREPOSITIONS TEST 212

APPENDIX B - SPATIAL PREPOSITIONS TEST 216

APPENDIX C - SAMPLE OF SUBJECTS' RESPONSES ON VERBAL (ORAL) — VERBAL (ORAL) STIMULUS-RESPONSE SECTION 227

APPENDIX D - SAMPLE OF SCORING FOR VERBAL (ORAL) — VERBAL (ORAL) STIMULUS-RESPONSE SECTION 240

APPENDIX E - CALIFORNIA SHORT-FORM TEST OF MENTAL MATURITY, LEVEL 0 AND LEVEL 1 AND GATES-MACGINITIE READING TESTS, PRIMARY A AND B 245

LIST OF TABLES

Table		Page
I	Mean Chronological Age, SES, I.Q. and Reading Achievement of Subjects in Sample by Grade and Sex	63
II	Mean I.Q. Scores of Subjects as Measured by the California Short-Form Test of Mental Maturity	67
III	Distribution of Subjects Within Test Sample by Socio-Economic Status	70
IV	Levels at Which Prepositions were Introduced in Readers	79
V	Performance of Pupils on Spatial Prepositions Test Sectionsby Grade	91
VI	Frequency Distribution of Pupil Scores On The Spatial Prepositions Test by Mode and by Grade	96
VII	Performance of Boys and Girls on Spatial Prepositions Test Sections by Grade	102
VIII	Performance of Pupils on Spatial Prepositions Test Sections by SES	104
IX	Performance of Pupils on Spatial Prepositions Test Sections by Total I.Q. ...	106
X	Performance of Pupils on Spatial Prepositions Test Sections by Language I.Q.	110
XI	Performance of Pupils on Spatial Prepositions Test Sections by Non-Language I.Q.	114
XII	Performance of Pupils on Spatial Prepositions Test Sections by Chronological Age	118
XIII	Performance of Pupils on Spatial Prepositions Test by Reading Achievement ...	127

Table		Page
XIV	Correlation of Variables of Socio-Economic Status, Intelligence, Chronological Age and Reading Achievement with Understanding of Spatial Prepositions	132
XV	Summary of Analysis of Variance by Grade, Sex and Two Modes of Stimulus-Response Test Sections	138
XVI	Summary of Analysis of Variance by Grade, SES and Two Modes of Stimulus-Response Test Sections	140
XVII	Summary of Analysis of Variance by Grade, SES and Two Modes of Stimulus-Response Test Sections	141
XVIII	Summary of Analysis of Variance by Grade, Language I.Q. and Two Modes of Stimulus-Response Test Sections	143
XIX	Summary of Analysis of Variance by Grade, Non-Language I.Q. and Two Modes of Stimulus-Response Sections	144
XX	Summary of Analysis of Variance by Grade, Chronological Age and Two Modes of Stimulus-Response Test Sections	145
XXI	Summary of Analysis of Variance by Grade, Sex and Three Modes of Stimulus-Response Test Sections	147
XXII	Summary of Analysis of Variance by Grade, SES and Three Modes of Stimulus-Response Test Sections	149
XXIII	Summary of Analysis of Variance by Grade, Total I.Q. and Three Modes of Stimulus-Response Test Sections	150
XXIV	Summary of Analysis of Variance by Grade, Language I.Q. and Three Modes of Stimulus-Response Test Sections	152
XXV	Summary of Analysis by Grade, Non-Language I.Q. and Three Modes of Stimulus-Response Test Sections	153

Table		Page
XXVI	Summary of Analysis of Variance by Grade, Reading Achievement and Three Modes of Stimulus-Response Test Sections	154
XXVII	Summary of Analysis of Variance by Grade, Chronological Age and Three Modes of Stimulus-Response Test Sections	157
XXVIII	Proportion of Subjects Scoring Correct Between Mode Test Sections	159
XXIX	Order of Difficulty Level of Prepositions Between Test Sections by Grade	164
XXX	Comparison of Prepositions Correct Within Each Mode Section by Kindergarten	168
XXXI	Comparison of Prepositions Correct Within Each Mode Section by Grade One ...	169
XXXII	Comparison of Prepositions Correct Within Each Mode Section by Grade Two ...	171

LIST OF FIGURES

Figure		Page
I	Pupil Performance on Spatial Prepositions Test	94
II	Distribution of Scores on The Spatial Prepositions Test in Kindergarten	97
III	Distribution of Scores on The Spatial Prepositions Test in Grade One	98
IV	Distribution of Scores on The Spatial Prepositions Test in Grade Two	99
V	Pupil Performance on Spatial Prepositions Test by Total I.Q. Across the Grades	107
VI	Pupil Performance on Spatial Prepositions Test by Language I.Q. Across the Grades	112
VII	Pupil Performance on Spatial Prepositions Test by Non-Language I.Q. Across the Grades	115
VIII	Pupil Performance on Two Sections of Spatial Prepositions Test by Language and Non-Language I.Q. Across the Grades..	117
IX	Pupil Performance on Spatial Prepositions Test by Chronological Age Across the Grades	120
X	Pupil Performance on Three Sections of Spatial Prepositions Test by Language and Non-Language I.Q.	126
XI	Pupil Performance on Spatial Prepositions Test by Reading Achievement	129

CHAPTER I

THE PROBLEM

> "...The learning of the meaning of such words as right, left, up, down, etc., in a great variety of situations is the basis of our being able to interpret even the commonest of our perceptions."
>
> Sir Henry Head

INTRODUCTION

In recent years the learning of concepts has become an important objective in all areas of school curriculum. The interests of psychologists, mathematicians, and linguists in children's concepts have contributed to this increasing concern.

Knowledge of the formation and development of children's concepts is of great importance to educators in curriculum planning and instruction. Unless the extent of development of a child's concept is known, it is extremely difficult to assess the type of information which he will be able to handle meaningfully. An awareness of the thought processes which children use in concept development, of the manner in which they utilize these processes, and of the concepts children have, are essential if sound teaching practices are to be employed.

In the teaching of reading, the concepts of the reader assume great significance in the provision of a framework and guideposts for thinking. Using these, a wide variety of experiences can be labelled, identified, classified and organized. A child's understanding of what he reads depends on his level of concept development. Russell (1954) considers words to be the key to the evaluation of concepts and measurement of knowledge of a concept depends upon the words associated with it. Adequacy of concept for reading comprehension implies breadth of understanding (knowledge of multiple meanings of words), and depth of understanding (total understanding of a word versus synonym recognition), and an intelligent interpretation of the symbols that represent words. Meaning when reading comes with the child's cognitive functioning using concepts that reflect his understanding. Efficiency in categorizing, in generalizing and in making meaningful associations are evidence that a child understands the concepts represented.

There are many types of concepts and conceptual abilities that become available to children as they develop - concepts of time, space and social relations; concepts of size, weight and number. Russell (1956) points out that while even preschool children develop an enormous number of concepts, there is a great deal of overlapping and mutual reinforcement of concepts within the various categories.

In all fields of the school curriculum, one of the most

important concepts which the child must master is the concept of space. Concepts used in descriptions of space form a basis for both scientific and mathematical thinking. In particular, a child's conception of space has relevance to his perception and comprehension of letters, words, numbers, geometric figures and other spatial configurations.

The term spatial concepts as described in research literature, has a wide range of meanings - from the ability to estimate the number of blocks in a pile to the comparison of geometric areas. The concept of space as used in the present study implies relationships of position in space. Prepositions like in, to, above, below, beside and near correspond to concepts of relative spatial position.

This study will ascertain young children's understanding of the basic concept of spatial position as evidenced by their oral, aural, and reading understanding of prepositions of spatial position to determine whether this knowledge and understanding is developmental, and if so, to investigate the pattern of its development.

BACKGROUND OF PROBLEM

The notion of space can be understood as a function of objects and their relationships as relationships between objects and movements of objects create space (Meyer, 1940: 119). Frostig has defined perception of the concept of spatial

relationships as "the ability to perceive two or more objects in relation to each other". This perception requires a response by the child according to Sigel (1964:227) who referred to a spatial relationship concept as "the ability of children to respond to relationships between items in space".

Three levels of understanding involved in the acquisition of this concept by young children are seen by Sonquist and Kamii (1968:177):

(1) Learning object-to-object spatial relationships in a motor way (e.g., putting a cup <u>on</u> the table).

(2) Recognition of position of objects without actual manipulation.

(3) Recognizing positions in space from pictures and verbalizing the spatial relationship.

The research in the study reported includes an examination of the first two phases of concept development listed by Sonquist and Kamii and seeks further to obtain information with respect to another level of prime concern in reading, namely, understanding of the verbalizing of spatial relationships in printed form. This level replaces the third level of spatial understanding set forth by Sonquist and Kamii.

A concept is a system of learned responses. The child first perceives the world around him through physical activity and manipulation in perceptual problems. With the development of language, he is further able to differentiate his

perceptions and organize and interpret his concepts. He becomes able to represent his experiences in words.

While concepts related to the reading process are verbalized concepts and as such can be expressed through words and syntactical devices, a child's knowledge of words, or his vocabulary, and his knowledge of concepts are not identical. As Vinacke (1952:100) has observed, a verbal response must be recognized as merely a label for the internal cognitive system which is actually the concept from the psychological standpoint.

Concepts are the cognitive structures which each child must develop in the course of intellectual functioning. In learning a word, the child must perceive various instances of a given word as similar and differentiate among the contexts in which a given word or word pattern is used. Learning a concept on the other hand, involves a responding to the similarities among experiences and to the range of variations in such a series of experiences. It is this response to the range of variations which allows differentiation among concepts.

When the child first uses words, he is using them merely as accompaniments of action. Gradually, he uses words as names or representations of objects and events. But even when words are used by children as names in a representative way, they are not necessarily concepts in the way that they are for adults. For example, most nouns are for adults names of classes of objects rather than merely names of unique objects.

That is, a noun in a sentence refers to a specific object, but the word is understood to be applicable to any of the class of objects of that noun. The young child does not clearly understand this, that members of a class differ from one another or that they are alike in their membership in the class. Flavell (1963:238) expresses it thus:

> "When the child struggles with the notion that the word is a label for a class of objects or actions, he meets for the first time the necessity for understanding a genuine concept; and when he does really understand what a noun signifies, he has achieved his first genuinely conceptual thinking".

The child's initial concepts of objects and their relationships among themselves are acquired through concrete experiences with objects and these are subsequently combined and manipulated to form the more complex concepts. Thus, concepts of increasing levels of complexity are based on a hierarchy of concepts dealing with objects and their relationships. Serra (1953:275) states that concepts are also symbolized and verbalized by the individual and the symbols or words in themselves become new concepts with a new hierarchy. Studies by Welch and Long (1940) indicate that children can use a two-step hierarchy between two and four years of age (men, women - people) and that most kindergarten children can grasp a three-step hierarchy (potato-food-vegetable). When they begin reading, children can add further "layers of meaning" to their concepts. For example, when children first learn to read the printed symbol <u>run</u>, the word is used to signify a verb meaning to move swiftly. At a later level

in reading, children will learn what it means to "run its course", to "run a garage", to "run a splinter in a finger", to "run across a friend", to "knock a home run", and so on.

Thus, an approach to the understanding of concepts in the reading process becomes involved in word meaning. The meaning of a word is a concept which is standardized by society. Carroll (1964:226) has pointed out that the relationships between speech community "meanings" and individual "concepts" are complex. While a word meaning is a standardized product, a concept of that word may vary with the individual, depending on his experiences of the referent of the word. The question is whether the child is aware of and in accord with the common agreement concerning the meaning of each word (Serra, 1953:275).

An additional problem is that many words have multiple meanings and therefore symbolize different concepts. Moreover, words can have different meanings in terms of the experience of the author, in terms of the experience of the reader and in terms of the contextual setting in which they are found. The task in reading instruction becomes one of attempting to bridge the meaning gap among these important factors.

Watts (1944:149) noted that as a child matures, an increasingly prominent aspect of his verbal behavior is the degree to which it corresponds to the syntactical structure of his language. He found that the precise meaning of pre-

positions denoting position in space was seldom understood by children below the age of five years. These general, abstract terms were employed and understood by children of this age almost entirely with specific reference to certain particular situations only. Watts is of the opinion that general and abstract terms convey meaning to any except the brightest of young children only as they bring to mind familiar forms of behavior.

Summary Statement of Problem

The problem to be investigated in this study is the development of understanding of prepositions of spatial position by children in kindergarten, grades one and two. In order to comprehend these terms, the child must have a basic concept of spatial position and be able to determine the meaning of spatial prepositions according to the context in which they are used.

THE NEED FOR THIS STUDY

Prior to coming to school, children have been accumulating experiences on which their concepts are based. Many concepts are vague and inaccurate. Stauffer (1968:40) has said that when children are learning to read, they are learning a new set of symbols (printed words) to stand for another set of symbols (spoken words) which stand for their concepts.

This author reports that a kind of mental discipline is required that was not needed when the child acquired the first set of symbols - spoken words. The child must learn to attach "societally-standardized words and meanings" to the concepts he has already formed or he must form new concepts that correspond to these "standardized words and meanings".

It may be concluded that knowledge of how the development of specific concepts proceeds is required if use of accurate concepts is to be stressed in early reading instruction. Moreover, whether children understand the precise meaning of specific concepts should be known. Useful information with respect to the concept of spatial position in early reading instruction would seem to be whether such spatial relationships as on, under and over need clarification and development. Perception and recognition of printed words, the verbal representations of these concepts, could then be built on this foundation. It was precisely the above information that was sought in the present study.

STATEMENT OF PURPOSE

The purpose of this study was to investigate young children's oral and reading understanding of the accurate meaning of selected prepositions of spatial position. The research involved had a threefold purpose: (a) to determine whether children in kindergarten, grades one and two under-

stand aurally prepositions of spatial position, and whether they use them correctly in speech; (b) to determine whether children in grades one and two understand these prepositions when they encounter them in their reading; (c) to ascertain whether understanding of spatial relationships is developmental, both orally and in reading, and if so, to investigate the pattern of this development.

DEFINITIONS OF TERMS

For purposes of this study, terms used throughout the study are defined as follows:

(1) Spatial relationships - the position of two or more objects in relation to each other.

(2) Terms of spatial position - prepositions which define the position of an object. Terms used will be those included in the McLeod Prepositions Test. This test contains the following twenty prepositions:

(a) on the right
(b) beside
(c) around
(d) behind
(e) in front of
(f) on
(g) over
(h) between
(i) through
(j) outside
(k) above
(l) across
(m) on top of
(n) beneath
(o) out
(p) on the left
(q) below
(r) underneath
(s) inside
(t) near

(3) Modes of stimulus-response - the manner in which the subject will respond to a given stimulus to demonstrate understanding of prepositions.

(4) Verbal (Oral) — Non-Verbal stimulus-response - a non-verbal response given by the subject by placing an object in a spatial position indicated in a sentence given orally by the examiner.

(5) Verbal (Oral) — Verbal (Oral) stimulus response - an oral response given by the subject to a question directed to him orally with respect to the spatial position of an object.

(6) Reading — Non-Verbal stimulus-response - a response given by the subject by placing an object in a spatial position indicated in a sentence read orally by the subject.

(7) Developmental - a statistically significant difference in pupils' scores which represent the ability of children to comprehend spatial prepositions at the grade levels of kindergarten, grades one and two under the conditions outlined in the previous section of this chapter.

(8) Kindergarten - a group of pre-school children receiving instruction as specified by the Department of Education, Government of Alberta, in their Kindergarten Manual.

(9) Grade One - pupils in their first year of school.

(10) Grade Two - pupils in their second year of school.

(11) Understanding prepositions - the score children obtained on the Spatial Prepositions Test, the research instrument devised for the study.

HYPOTHESES

The following null hypotheses were tested:

(1) There is no significant interaction between

(a) Sex and mode of stimulus-response
(b) Grade and mode of stimulus-response
(c) Reading achievement and mode of stimulus-response
(d) Socio-economic status and mode of stimulus-response

on the understanding of prepositions as tested by the Spatial Prepositions Test.

(2) There is no significant difference between scores of children in kindergarten, grades one and two first on the Verbal (Oral) — Non-Verbal section and then on the Verbal (Oral) — Verbal (Oral) mode of stimulus-response section of the Spatial Prepositions Test.

(3) There is no significant difference in children's scores between the Verbal (Oral) — Non-Verbal and Verbal (Oral) — Verbal (Oral) modes of stimulus-response sections of the Spatial Prepositions Test.

(4) There is no significant difference between test scores of children on each of the Verbal (Oral) — Non-Verbal, Verbal (Oral) — Verbal (Oral), and Reading — Non-Verbal modes of stimulus-response sections of the Spatial Prepositions Test for grades one and two subjects.

(5) There is no significant difference in each stimulus-response mode between test scores on the Spatial Prepositions Test of

(a) boys and girls in each grade.

(b) subjects of higher and lower socio-economic status in each grade.

(c) subjects of high and low intelligence in each grade.

(d) subjects of high and low reading achievement in grades one and two.

(6) There is no significant correlation between pupils' scores on items testing selected spatial prepositions for each stimulus-response mode section in each grade and

(a) intelligence
(b) chronological age
(c) socio-economic status
(d) reading achievement (grades one and two only).

(7) There is no significant difference in the difficulty level of the prepositions where level of difficulty is defined to be the proportion of pupils in each grade who score correct on each preposition tested between modes of stimulus-response sections of the Spatial Prepositions Test.

(8) There is no significant difference in the difficulty level of the prepositions where level of difficulty is defined to be the proportion of pupils in each grade who score correct on each preposition tested within each mode section of the Spatial Prepositions Test.

OVERVIEW OF THE STUDY

Population and Sample Used

The population consisted of all children attending

regular classes in the Edmonton Public School System, in kindergarten, grades one and two. From this population, a representative test sample of 120 children was selected randomly from two elementary schools designated by officials of the Edmonton Public School System. There were forty subjects in each of kindergarten, grades one and two. An additional fifteen children, five children from each of kindergarten, grades one and two were used in a pilot study only in a third school designated by officials.

The test sample for the main study was stratified according to sex and socio-economic status. There were equal numbers of males and females from each of a higher and lower socio-economic status area in each grade.

Procedure

In order to examine comprehension of spatial prepositions, a prepositions test with the following modes of stimulus-response sections in this test was utilized:

Stimulus-Response	Grades
1. Verbal (Oral) — Verbal (Oral)	kindergarten, grades one and two
2. Verbal (Oral) — Non-Verbal	kindergarten, grades one and two
3. Reading — Non Verbal	grades one and two

This test was administered to each subject individually by the researcher. The responses of the subjects were recorded

in writing, for later analysis, in a prepared data collection booklet. These booklets were designed so that each grade commenced with a different subtest section and within each grade, half of the subjects were given the subtest sections in a different order from the other half of the subjects. In addition, subjects' responses on the Verbal (Oral) — Verbal (Oral) stimulus-response section were recorded on a cassette tape recorder so that they might be transcribed and typed later before being scored by the investigator.

In addition to the above scores, an intelligence quotient for each pupil and a measure of reading achievement for grades one and two were obtained in the study.

Testing for the pilot study was conducted in March, 1970 and the investigation proper was carried out during April and May, 1970. The test used to measure achievement in reading was administered in June, 1970.

Subjects' scores in the main investigation were punched onto IBM cards and programmed by the computer center at the University of Alberta. The scores were subjected to three-way analysis of variance, computation of correlation coefficients, and to a z test of the difference between proportions.

LIMITATIONS OF THE STUDY

An interpretation of the findings of this research should

give consideration to the following limitations:

(1) The test used to determine children's understanding of prepositions of spatial position is not standardized and all sections of the test are being used for the first time.

(2) The scoring procedures utilized were devised by the investigator for the present study and hence have not been used in previous research.

SIGNIFICANCE

Information obtained with respect to prepositions of spatial position which children understand in kindergarten, grades one and two, will assist primary teachers in planning reading and language curricula to meet the needs of children at these grade levels. If it is found that some prepositions are not understood at a grade level, it could lead to further research to ascertain whether the concepts represented by the prepositions can be taught at that grade level. Should the results indicate that 'difficult' prepositions are also those found in a particular grade reading program, the need for development of these concepts in the reading instruction for that grade level will be indicated.

The study is undertaken in the hope that it will provide educators of young children with additional knowledge of how the concept of spatial position develops. Should

sex, socio-economic status, chronological age, intelligence and reading achievement be indicated as factors influencing the understanding of prepositions of spatial position, it should facilitate adaptation of programs of instruction to meet differences in children in each grade resulting from these variables.

ORGANIZATION OF THE REPORT

In this chapter, the topic of the investigation was stated, and a general overview of the scope of the study was given. The concept of spatial position was discussed within the larger framework of concept formation in general. It was related to the reading process as a verbalized concept in printed form represented by prepositions of spatial position. The following is an outline of the balance of the study:

Chapter II - Theoretical Background and Related Research

Chapter III - The Experimental Design of the Study

Chapter IV - Analysis of Data and Findings of the Study

Chapter V - Summary, Conclusions, Implications and Suggestions for Further Research.

CHAPTER II

THEORETICAL BACKGROUND AND RELATED RESEARCH

In this chapter, the research findings which have made a contribution to the problem under investigation will be reviewed. The studies selected pertain to concept development in general, spatial concept development specifically and concept development related to reading as a thinking process.

As various writers on concept development have stated, there has been more research on children's knowledge of concepts than on most other areas of children's thinking. Research in the area goes back as far as the studies of G. Stanley Hall (1891) which were concerned with "the content of children's minds". The more recent literature available on concept development in young children is generally concentrated in three broad areas. The first of these concerns how concepts are attained; the second includes the role of verbalization in the acquisition of concepts; and the third deals with factors influencing concept development. For purposes of clarity, this classification will provide a basis for the discussion on spatial concepts to follow. Studies have been selected from each of the main areas of concentration in the field of study. The chapter concludes with a section on the role of concepts in reading.

DEVELOPMENT OF SPATIAL CONCEPTS

Development of Concept of Space

According to Piaget (1954:145-146), a leading investigator of children's concepts, acquisition of spatial concepts occurs concomitantly with the acquisition of concepts of object permanence, that is with the ability to think of the object independently of what can be done with it. Piaget theorized that the child's earliest ideas are that there are many kinds of spaces, each dependent of where he is at that point. He identified a series of six developmental stages in which the young child learns to comprehend a single objective space, encompassing objects, persons and events.

First, the child's concept of space is that of unrelated separate spaces. Space is only a property of action, developed as action becomes coordinated.

Development of Concept of Spatial Relations

Next occurs the beginning of space perception and their spatial relations to each other, to the child and to the general surroundings. The child at this stage still does not conceive of spatial relations independent of acts. The third stage is a complex and critical developmental one in which he begins to grasp what he sees. Movements with his hand give the child the opportunity to experiment with depth. The sphere expands little by little and the objects are regulated in relation to the child's body itself. As described

by Piaget (1954:145-146), "distant space merely appears then as a kind of neutral zone in which prehension is not yet ventured while near space is the realm of objects to be grasped". As the child moves into the fourth phase, he is beginning to increase the differentiation between subjective space (perception of space from the point of view of the subject) and objective space (perception of space from the point of view of objects). As he searches for objects he is able to perceive the spatial relationships between himself and the place of the objects. If an object is under the pillow, he distinguishes between it and the pillow. He is beginning to show primitive concepts of distance perspective and so to maintain a notion of constancy of size of the object. During the two subsequent stages the child shows an increasing understanding of the relationship among objects in space, for instance, putting objects into containers, and stacking them on top of one another. In the final stage the child is able to understand relationships of objects in their spatial concepts. Space constitutes a "motionless environment" in which the child himself is located.

The concepts of space and object permanence and the stages of their acquisition are highly related as the child is continuing to differentiate not only spaces but objects in it. Furthermore, he separates himself from objects and realizes that he, too, is an object in space. He is moving toward objectivity. Piaget wanted to demonstrate that percep-

tion of space and the representation of space are intellectual concepts and end products of a long development sequence. The development of these spatial concepts in young children appears to depend upon actions in space rather than just the perception of it. Piaget's description of the stages of evolution in the concept of space was based on studies of children from birth to 2 years of age.

Support for Theory of Developmental Sequence Concept of Space

Support for Piaget's hypothesis is given in a study by Meyer (1940) who examined the comprehension of spatial relationships in sixty-three children between the ages of two-and-a-half and five-and-a-half years. She found a developmental sequence from "practical space" to "subjective space", beginning about age two-and-a-half. Up to the age of two-and-a-half, the child behaved as if he moved in a "practical space" in which objects were only present to satisfy his activity. All his needs were centered around exercising activity patterns recently acquired during the sensory-motor development of the first two years. Objects mainly had reality in relation to the child himself and he neglected relations between objects. Between the ages of three and four years, the child moved in a "subjective" or "empirical" space. He began to show an interest in the objects themselves, though he was still centered upon himself and upon his acting upon things. But at this stage his activity adapted its

patterns to the conditions of the environment even though he still felt himself to be the center of this environment. He moved an object only toward himself; when an object was rotated away from him he did not consider that the object had an independent path of its own which included more than the parts visible to him. After the age of about four years, the child started to move in an "objective" space. The child set out to live in the world of objects and no longer to make things exist merely for his own satisfaction. He understood the spatial relations within his world of objects, he understood their independent movements and he knew how to coordinate his movements with theirs. Space at this age was found to be an objective space whose relations were understood apart from all relations to the child himself. He knew that he had to consider himself as one object among other objects in space, and he understood the relativity of the positions of the objects.

This report by Meyer generally corresponds to Piaget's description. A sequence of development in the concept of space is also indicated in the early research of Freeman (1916) who suggested that a child locates objects in space, first, with reference to himself, second, with reference to a second object of which the location is assumed to be familiar, and third, by means of a system of fixed directions.

Responding to Spatial Relationships

Research indicates that a child's ability to respond to the relationship between items in space is necessary in order to form a spatial concept of position. Miller (1934: 277) concluded that the position objects are in provides a very early clue which children can employ in ordering objects in the environment. The most common spatial relationships noted were those that are the simplest. Watts (1944:41) found that positions like up, down, below, over, and above were understood by children at the nursery school age (3-5 years). The Russian investigator Sohkin (Smith and Miller, 1966:383) studied children's responses demonstrating understanding of the spatial positions of on and under and decided that:

> ...it is more difficult to understand under than on, in that the former requires that one object he lifted and the other placed beneath it. Some children held one object under the table, rather than lift up the object lying above it on the surface of the table .

Sohkin argued that the beginning meanings of words are tied to actions and that under in most situations does not require that an object be lifted. Children who made mistakes performing in the experimental situation could often show correct comprehension in an "everyday situation". As far as the writer is able to determine, Sohkin investigated only two prepositions, on and under, perhaps because the children he examined were so very young (ages 1 year, 11 months - 3 years, 5 months). Consequently his findings are of limited value.

The study does indicate, however, the need for caution on the part of an investigator. It is not enough to look for the earliest behavior recognized as correct and to treat all responses falling short of this criterion as wrong without further investigation. As Russell (1956:122) has stated, a concept may be known thoroughly, partially, inaccurately or not at all.

It was Annett's (1959:235) contention that explanations of place depend upon physical contiguity in space. Her study of 300 children, aged 5-11 years, revealed that young children used four main types of content in classification and the most numerous at all ages were those concerned with spatial position and activity. It seemed that children first needed to analyze the characteristics of individual objects and then to consider how these objects were organized in space before they could attend to significant similarities. The methods of explanation by the children in this study, from no explanation to contiguity, enumeration, similarity, and finally class name could be interpreted as representing stages of development.

Annett's conclusions are in agreement with Piaget's (1956) theory that young children under the age of eight years have little idea as to the spatial relations of objects which they are not acutally observing at the moment. Relative to these theories, the present study sought information as to whether the kindergarten and grade one subjects, who

were under eight years of age, required this visual cue when demonstrating understanding of spatial relations.

Section Summary

In general, the development of spatial relations is thought to involve operations which are "internalized actions". Investigators of concept development recognize that there is an interdependence between space concepts and spatial relations and that both of these concepts are acquired by young children in a step-by-step developmental process. It appears that the earliest concepts of spatial position are dependent upon the child's sensory-motor and kinesthetic experiences.

ROLE OF VERBALIZATION IN CONCEPT FORMATION

Language and Processes of Concept Acquisition

Researchers have indicated that language assumes an increasingly important role in the processes of concept acquisition. It is claimed by Werner and Kaplan (1950) that the reality of a concept comes into existence only through the medium of language. Underwood (1966:63) states that it is sometimes difficult to make a distinction between concept learning and verbal learning. According to Mukerji (1968: 167) concept formation and language development are interdependent processes because "virtually every word other than proper nouns represents a concept". The important role of

verbalization in concept formation is also recognized by Russell (1956:230) when he suggests that "power in language both increases the efficiency with which concepts can be acquired and the range of those concepts".

Serra (1953:275) argues that verbalization is not essential to indicate the existence of a concept, that behaviour may demonstrate its acquisition. A similar view is expressed by Smoke (1935) who concluded from experimental investigation that one may have concepts without corresponding verbalizations.

But a child's concept to be communicable, must be represented by a symbol that is understood by others to carry the same meaning that the child intends. This symbol is usually a word. Reading is concerned with verbalized concepts and printed words are the representational symbols. Thus, symbolization increases for the child as these written symbols begin to be mastered.

Concept Development, Language and Thought

If a concept determines the course of thought as Vinacke (1952:100) has suggested, it follows that the study of a child's concept development involves understanding the relationship between thought and language. Piaget's (1959) concept and description of language and thought in children below the age of about seven years would seem to be fundamental to an understanding of a child's mode of thinking at

the beginning reading age. While words play an important role in facilitating the development of concepts, conceptual thinking does not automatically occur when a child learns to talk. Mukerji (1968:167) states however, that the later "what's that" stage of language development signifies a particularly active stage of early concept acquisition. It seems clear that in mastering speech the child starts with words but words cannot be added 'ready-made' to thought. The relationship between thought and word is not a symbol experience "thing" but a process that is undergoing constant change (Stauffer, 1965).

The importance of words, as related to verbalized concepts has been emphasized by Vinacke (1955) and Carroll (1964). "When a child reads, the words serve as evokers of concepts - <u>if the concepts are there to be evoked</u> (Vinacke: 572-573). Carroll (p. 225) agrees but adds that the connection must work in either direction: "the word must evoke the concept and the concept must evoke the word".

Words are employed by children in both the development and utilization of most concepts. Russell (1956:118) illustrates this by stating that while a young child may depend partly on his tactual, kinesthetic and visual responses to develop his concept of <u>toy</u>, it helps the generalization when he can say, "The toy is to play with", and "Toys are things that go and some stay still".

Vygotsky (1962) maintains that it is in word meaning

that thought and speech unite. This idea is supported by Serra (1953) and Dunkel (1944) who state that the problem in studying concept formation is whether the child understands the precise 'word meaning' as many words possess multiple meanings depending on the context in which they are used. If, as LaBrant (1949) maintains, a young child has one meaning for each word and cannot conceive of it as having another, the problem is a complex one. Another aspect to be considered is that young children may understand the words in context but be unable to isolate distinct words in order to give an explanation of them (Watts, 1944:128).

The objective of the follow up when children display initial hesitation in object placement in this study is to observe whether children in kindergarten, grades one and two who can indicate correct spatial position can also pick out the preposition as a single entity and give an explanation of its meaning.

Language and Concept of Spatial Relationships

According to Jensen (1967:113) different syntactical structures represent different parts of speech and different degrees in which learning is facilitated. In order to interpret perceptions and recall them once they are out of the field of perception, the child must understand relation words. Luria (1959) suggests further that the child must learn to associate utterances with actions.

Research has shown that spatial relationships are difficult for children to learn because they require the abstractions of connections among objects. The young child has to observe the relationships which exist among objects and at the same time learn the language terms (prepositions) for observing what he sees. Jesperson (1921:138) writes that prepositions appear late in a child's language (average age 2.3) and the tendency to use prepositions, after it does appear "grows far more rapidly than the power to discriminate one preposition from another". This observation concurs with the research of McCarthy (1930) who found that prepositions do not appear among eighteeen month old children but increase in frequency with age from about three per cent at two years to approximately seven per cent among children of four and five years. Recently, Menyuk (1969:56) has stated that the percentage of children using preposition redundancy in their utterances at the nursery school level ranks high ("I shop in over there"). She explains that the reason for this may be a general uncertainty about the appropriate selection of prepositions. In addition, there is difficulty in determining the correct preposition "to denote place, manner and time in specific contexts".

Another explanation suggested by Menyuk is that various terms for such concepts as place have not as yet either been acquired or are not clearly defined. Therefore there is an elaboration of terms to give finer definition to the available

prepositions ("He gets all the way close" for 'almost near') and an elaboration of terms because a member of the term is not clearly understood ("He went beside from the house" for 'beside'). Frequent use of near, beside, between, and so on, in grammatical form is not found. An earlier stage of development, according to Menyuk, might be a more frequent use of substitute prepositions ("She wants to stay at the puppy").

Although the children investigated in the present study were older than those studied by Menyuk, responses were analyzed for inappropriate use of spatial prepositions to see whether redundant and substitute prepositions were present at this later stage of development.

In a study by Ames and Learned (1948) of the development of verbalized space in nursery school children, it was found that prepositions could be understood first in connection with object words, and later when used alone. On the table, in the box, under the bed, were used and understood before the more abstract in, on, under. The child went through a looking, pointing, verbalizing sequence. He looked as the older person mentioned "over there", later he pointed himself to convey meaning and finally he could use the concept specificially in answering questions. Dolch (1927), Watts (1944), Dunkel (1944) and Reichard et al. (1944) have all agreed that words that cause the most difficulty for children are those that act as symbols for abstractions and generalizations.

A similar viewpoint with respect to reading has been expressed by Vygotsky (1962). Vygotsky replicated and expanded the research started by Piaget on the relationship between children's thought and language but turned his attention directly to the problem of reading. One of the main conclusions from his research was that the abstract quality of written language is the main stumbling block in teaching children to read with understanding.

Russian investigators have pioneered in the investigation of the role of verbalization in the acquisition of concepts. They have postulated that mastery of the elements of grammatical structure is both a condition and a means of development of the pre-school child's thought. In Liublinskaya's (1957) research on understanding of spatial connections, instruction was first given in the correct use of appropriate prepositions by means of games. A control group had no instructional activities. The results after the experiment showed that change was expressed not only in the increased number of prepositions used but also in the accuracy with which these "spatial connections" were expressed. Liublinskaya (p. 102) gave recognition to the importance of language in children's thinking when he declared "spatial connections can be perceived only by perceptual contemplation, but even so they are only understood when given a verbal designation". This report does not indicate how many prepositions were investigated nor the length of the period of instruction which

makes it difficult to evaluate as significant research. It does indicate, however, that a higher level of thinking can be attained by young children through appropriate guidance and direction. In another study by Feofanov (1966) children of ages three to seven were asked to describe pictures and actions, and their use of prepositions was noted. The earliest prepositions used were those occurring most frequently in the language; these were also the prepositions having the greatest number of meanings (i.e., on, in). Feofanov's investigation is one of the research studies of prepositions used by children beyond the pre-school age level and is of interest and significance to this study for that reason.

Recent research in young children's understanding of spatial relationships was conducted by McLeod (1969). McLeod examined kindergarten children's comprehension of twenty prepositions of spatial position by utilizing three modes of responses; Non-Verbal, Controlled-Verbal and Free-Verbal. In the Non-Verbal mode of stimulus-response section, the subject was asked to place an object in a spatial position at the verbal request of the examiner. For the Controlled-Verbal response section, a 'yes' or 'no' response was required of the subject to a question directed to him verbally and an explanation was given for the positive or negative response. The Free-Verbal response portion of the test measured the verbal language a subject used to describe the spatial position of an object. A model farm with minature buildings,

people, animals and machines were the test materials used and subjects were asked to manipulate the objects or observe how the objects were manipulated in the test sections.

In general, McLeod's results indicated that children of this age were able to achieve higher scores on the Non-Verbal response and lower scores on the Free-Verbal response which measured the language used by children to describe a spatial position. These children apparently had gained some understanding of prepositions of spatial position but did not as yet use them in speech. The study also indicated that children were able to understand prepositions of spatial position when they occurred in context. Of the twenty prepositions investigated, however, only one preposition, 'out' was given correctly for all three modes of response. Thus, children did not use or understand all of the prepositions tested. A limitation of this study is that the age level of the children investigated ranged only from 5 years, 8 months to 6 years 9 months and hence yields little information on the development of this concept in young children. The differences in understanding revealed when each of several modes of response were utilized may indicate that there is a different sequence of development in various types of response as seemed indicated even within a limited age level range.

Verbal Response and Concept Understanding

There is evidence from research that usage of a word by a child and ability to read that word is no assurance of his grasp of the meaning of the concept. A study by Gammon (1952), of comprehension of words with multiple meanings found in primary readers for the first, second,and third grades, disclosed that many of these common words were not accurately comprehended by "best and average children" in primary grades.

Another study by Herbers investigated the comprehension difficulties of thirty third-grade pupils as they use third-grade readers. Herbers' findings, similar to those above, are as follows:

(1) Pupils revealed inadequate and incorrect concepts of words, phrases and sentences.

(2) Materials which were used by the pupils with facility showed hazy and erroneous concepts.

(3) There was a lack of understanding of all items to which there were correct responses in the yes-no or multiple choice test.

Bedwell (1932) determined third grade children's comprehension of the number of concepts they read in their geography and history books and concluded that it is possible to have verbal or factual knowledge without having a functional concept. Bedwell's investigation, however, was based on a limited sample of only twenty-one children.

Clarke (1933) matched second graders by reading ability

and compared the results of comprehension of a simplified pre-school vocabulary level version of social studies material to the results of comprehension of the original text. She reported similar findings that correct verbal responses did not insure correct responses in demonstrated application of processes. Simplified material made a slight but consistent difference in comprehension but there was no advantage in simplifying technical words.

In Rawson's (1969) research with older children, there was strong evidence that there is a lag between the acquisition of certain concepts orally and the ability of the child to recognize these and react appropriately to them when they are presented in print. Reasoning from printed symbols appeared to present a rather different type of difficulty from reasoning on the basis of "verbal-concrete" data.

Rawson's research was carried out with nine-to-ten year old children. If, as Bond and Bond (1943:146) have stated, a more mature reader anticipates the words and concepts he meets in a passage, it seems logical that with younger children, such as those in the present study, evidence of lag between these two types of concept reasoning might be even greater.

It seems apparent that the assumption cannot be made that when words are decoded in reading they will be automatically understood. As Rawson (p. 295) explains it, decoding printed symbols by children is "decoding into sound";

reading for understanding is recalling concrete experiences which children have learned to associate with these sounds.

Section Summary

The consensus of the research findings suggest that language can both facilitate and direct the process of concept acquisition in young children. It is also generally conceded that abstract ideas are least appropriate at the beginning reading age. The child's ego-centric view of his environment at this stage is not conducive to a natural understanding of the purpose of the written form of language. Words and concepts are presumed to acquire meaning to the child during the early years through "the physical presence of the referent or concrete examples of the concept and some manner of reinforcement contingent upon the response" (Amster, 1965:546). Hence, the younger the school child, the more necessary it would seem to have sensory experiences with instances or examples of the concept. In addition, these instances should be put in proper sequence for learning.

It cannot be assumed, however, that reading thinking processes are identical to speaking-thinking processes. As yet, the differences between these two processes have not been revealed by research. Caution must be exercised to ensure that there is no overgeneralization concerning cause and effect when two independent events may only be occurring at the same time. Since the child is young and inexperienced and "thinks"

in a particular way, it may not be wise to suggest that any particular way of thinking is peculiar to the young child. The number of variables, both known and unknown is so great that reference to specific "ages and stages" of language and concept development become highly suspect. The studies of Loban (1963) and others, for instance, have emphasized that motivation to interact verbally is the most necessary prerequisite for growth in language. Piaget for one did not seem to relate this need to language development.

FACTORS INFLUENCING CONCEPT DEVELOPMENT

A review of research reveals that the concepts children bring to the page when reading and the concepts they attach to the words in their relationships are influenced by many factors.

Experience

Smith and Dechant (1961) see the child's development of a concept involving two major steps; abstracting or seeing the similarities within a framework involving dissimilarities and generalizing or evolving a general principle from his experiences. Concepts, as defined by Carroll (1964:220) are "the abstracted and often cognitively structured classes of 'mental experience'". He reiterates that a necessary condition for the formation of a concept is for the individual to have a series

of experiences that are in some respects similar. The similarities constitute the "concept" that underlies them. A further necessary condition is that there be some negative instances of the "concept" in the series of experiences. As concepts become more complex, similar and dissimilar instances must be appropriately sequenced to insure adequate learning of the concept.

Olsen (1965) postulates that some children lack experience and thus appear 'word-locked' when they are really 'concept locked'. These children may have full language development except in certain areas of activity valued by the school. In this situation the child may not have the concepts which come out of certain kinds of experiences so that he appears impoverished in his language. Olsen illustrates this by saying that if the teacher is talking about the milkman or "my summer trip", the child may be silent because he literally has nothing to say. These may be experiences which are foreign to the child. One of the reasons for using a model school and playground in this study was that the sentences heard and read by the children would then be about experiences which were already familiar to them.

Scholars such as Ausubel (1957), Estes (1956), Hunt (1961) and Sears (1959) hold that the child's development is the result of his learning experiences. Different levels of ability, knowledge and skills are the product of the function of such experiences. Cognitive styles of learning are

believed to influence the kind and content of experiences employed by a child in evolving his concepts (Kagan, Moss, and Sigel (1963); Sigel (1964)). That experiences are important in the acquisition of concepts is also emphasized by Harlow (1959:239):

> The concepts that a child acquires are influenced by the predisposition he shows to attend to particular features of the environment.

Osburn, Huntington and Meeks (1946) experimented with vicarious experience between the levels of direct experience and verbalization in sixty-seven kindergarten children. A series of exercises composed entirely of pictures, illustrating various relationships between the pictures, was used. No control group was used but the children were reported to have made scores on reading readiness tests which showed gains superior to average as a result of this training.

This experiment was carried out in an actual school situation so conditions would not have been ideal in so far as research investigation is concerned. It is even questionable whether the single factor of the language of relativity was isolated as the report states that "the teacher could not neglect many other factors that are known to contribute to the facilitation of reading readiness". A positive feature of this study is that it demonstrated that certain abstract relationships can be made concrete and meaningful to children of kindergarten age if appropriate techniques are used.

Cantor (1938) conducted an interesting study to ascertain

the value of excursions to assist kindergarten children in preparing them for first grade reading. This investigator found that 204 concepts were given background in experience through nine excursions taken, and that a correlation had been effected between the vocabulary and concept demand of primary reading and the vocabulary and concepts supplied by these nine kindergarten excursions. The children who had taken excursions in kindergarten were also checked for reading readiness and reading achievement in grade one. Cantor's conclusion in regard to the effect of the excursions on learning to read was:

> From results of scientific tests administered in the first year and the comparisons made with reading readiness in other schools, it seems probable that the children definitely profited from the comprehensive program of kindergarten excursions in their kindergarten year.

Cantor's investigation appears to be quite thorough in that she used four methods of checking the value of the excursions during the course of her study.

Mukerji (1968:33) has emphasized that a single experience, no matter how successful, is not enough to build a reliable concept in young children. She cites the work of Piaget, Bruner, Jersild and others as support for the proposition that children cannot move toward abstract reasoning without a broad base of experiences from which to abstract and generalize.

Anderson and Dearborn (1952) acknowledge that meaning in reading rests on experience. In addition, meaning is more

easily derived when words are in the context of experience. They illustrate by explaining that in attempting to read an experience chart, the young child has the previous experience as context to aid his word recognition and comprehension.

Summary

Concepts developed through much first-hand and vicarious experience is indicated as essential for success in early reading. While reading is basically a process of gleaning meaning from printed symbols these meanings spring from the mind of the reader who brings meaningful concepts to the symbols in terms of his own experience. It follows that the more direct the experience on which specific concepts are built the greater will be the child's knowledge and understanding of these concepts.

No attempt was made to measure experience in the present study, but a basic assumption of the study was that children in grade two would have had more experience than kindergarten and grade one children.

Socio-Economic Status

Piaget (1959) expressed the idea that the very essence of the cognitive development of the child is the socialization of thought which occurs within the child's environment. The structure of the social system and the family shape communication language and thought.

Differences in children's ability to express and understand abstract thoughts and concepts are related to the linguistic code and social structure of the family environment according to researchers Bernstein (1965, 1967) and Jensen (1967). Bernstein has outlined two kinds of communication, restricted and elaborated. A restricted code contains a smaller number of alternatives and is largely transmitted through additional verbal gestures. It is Bernstein's theory that children from a lower socio-economic status use a restricted code which handicaps them in cognitive development. Of interest to this study is one of the characteristics of an elaborated code listed by Bernstein - frequent use of prepositions indicating logical relationships as well as prepositions indicating temporal and spatial contiguity. Jensen (p. 106) states that middle-class language is more abstract and necessarily more flexible, detailed and subtle in its descriptive aspects. Moreover, spoken language is less like written language "syntactically, grammatically and in overall sequential organization and logical progress". Thus for the lower-class child, reading and writing are very different from speech.

The earlier research of Kagan, Moss and Sigel (1963) and of Templin (1957) also indicate underdeveloped verbal and conceptual ability of children from low socio-economic status homes. Because these children tend to rely on the restricted code to communicate, they are more apt to be tied

to the concrete and are therefore unable to function adequately at an abstract verbal level.

Deutsche (1937) reported only a very low relation of socio-economic status to scores on concept tests but her study has certain limitations. One of these has to do with the nature of her questions. They lacked variety to some extent, consequently the absence of some types of answer in her data might be accounted for by the kinds of questions she asked. Another limitation concerns the ages of her subjects, the youngest of whom were eight. Because of this age factor, some of the types of answers she looked for may have largely disappeared due to the maturation of the subjects.

Related to concept development and socio-economic status is another area in which some interesting recent and productive research has been carried out. This is in the area of mother-child communication. Hess and Shipman (1965) demonstrated that there is a relationship between the communication system of mother and child and the child's intellectual functioning and school performance. Investigation by Brown and Bellugi (1964) showed that mothers responded to the speech of their children with expansions which said in effect "Is this what you mean?".

One particular point noted about this study is that the forms added to the child's utterances included prepositions like in, on, to, and up. If, as Bernstein has suggested, lower-class mothers use these terms infrequently, the child

from a low socio-economic strata will be deprived of this type of guidance and stimulation through mother-child interaction.

It seems apparent, too, that some extension of the process of expanding a child's speech goes on throughout early childhood, by parents, teachers and older children; not just during the second and third years of life as Brown and Bellugi have observed.

An investigation was conducted by Worley and Story (1967) to determine to what degree entering first grade children of low socio-economic status groups differ in language facility from higher socio-economic status groups. Forty subjects were chosen for this research with an even division of boys and girls and both groups were carefully defined and controlled. Based upon statistical analysis, a difference of over a year was found to exist between the means of the two groups in favor of the higher socio-economic children.

Loban (1963), in an extensive study of the oral language of elementary school children stated that competence in reading and writing depends largely upon a child's competence in spoken language. In learning to read, the child must have a rich verbal milieu in which to operate and with it a basic understanding of concepts. It is this factor that has great implications for educators. Teachers must understand that if a child's cultural environment has not placed a high priority on verbalization, the child is in trouble before he even

attempts to learn to read. Such a child needs language experiences in order to develop a language base to take him from the restrictive code to the elaborate code stage.

Hess and Shipman (1965:885) have stated rather cogently that "the meaning of deprivation is a deprivation of meaning". Their argument is that the main quality involved in the effects of cultural deprivation on the young child is a lack of cognitive meaning in the mother-child communication system. In the deprived family context the number and kind of alternatives for action and thought open to the child are restricted which prevents a tendency for the child to consider and choose among alternatives for speech and action. It develops modes for dealing with stimuli and with problems which are impulsive, disconnected, and deal with the immediate rather than with the future.

Summary

The related literature supports the view that socio-economic status affects language and concept development. It would seem that it is the opportunities which accompany the status which at least partially account for the difference between children of high socio-economic status and low socio-economic status in the understanding of concepts.

By testing children from both higher and lower socio-economic status homes in this study, an attempt was made to ascertain whether a difference existed between these two

groups in the understanding of the specific concept of spatial position.

Chronological Age

Age has also found to be a possible factor in concept development. Vinacke (1955) pointed out that the child becomes less unique and more conventional in the meaning he ascribes to words as he grows older. His concepts usually become more similar to those with whom he associates which reflects the influence of culture on the development of concepts.

As examples of studies of chronological age changes in concepts, reference might first be made to an investigation conducted by Feifel and Lorge (1950). Their results revealed that there are successive stages in the concept formation and developmental thinking of children. When a qualitative analysis of their responses to a vocabulary test was made, no particular type of response was exclusively found at a particular age level but younger children up until the age of six or seven made more frequent use of description, demonstration, and inferior explanation. They saw words as concrete ideas and emphasized an isolated aspect of them rather than categorical or class features. Moreover, their descriptions were more personal than symbolic. In terms of size of sample and age range of subjects, this study was indeed comprehensive. The subjects comprised 900 pupils from 6 to 14 years of age.

These results support the findings of Piaget (1959) in

the evidence of changes in the conceptual level of development of children as they grow older. The work of Welch and Long (1940) further confirm that the conceptualizing ability of children seems to develop from simple to more complex levels with increase in age. Their studies which dealt mostly with pre-school children indicate that chronological age is at least as important as mental age in the formation of concepts in young children.

Another study of particularly pertinent interest in the teaching of reading is that of Reichard, Schneider, and Rappaport (1944). They identified three sequential levels of concept development: (1) the concrete; (2) the functional; and (3) the conceptual or abstract meanings. The concretistic performance was more typical of the youngest children (up to 5 or 6 years). These findings have significance for reading instruction, in that while reading depends on and promotes the development of concepts the pupil brings to, and gets out of a reading passage, concepts of varying complexity depending on the level of concept attainment at which he may be operating.

Corroboration of this research finding is indicated in a recent study with grades four and six children reported by Chase (1969:210-214) which measured reading comprehension on the basis of concept attainment by allowing pupils to respond at the conceptual level appropriate to them. Chase found that there was a significant relationship between con-

ceptual level and maturity, the more mature pupils appearing more often in the "abstract" category. He suggested that the differences might have been even more pronounced if the test had been administered to younger children.

McLeod's (1969) findings suggest that children's ability to use prepositions of spatial position undergoes a change with chronological age. A possible explanation for this, according to McLeod, might be that older children are no longer using language as an imitative process, but as their concepts of spatial position become clarified, they begin to search for the matching linguistic label.

The importance of maturation in the understanding of spatial concepts by nursery school children was recognized by Watts (1944:72) when he reported that:

> The ability to think and talk of things remote in space or time is on the whole a later achievement... Children learn to narrate early (a sequence of things in the mind's eye). This sometimes means, of course, that they have merely acquired a service of words which they have drilled into order without any clear apprehension of what is meant by them.

Summary

In general, investigations indicate that children grow in conceptualization ability from infancy throughout the period of childhood. It seems probable that it is age as a reflection of experience that affects the development of children's concepts.

In the present study, the effect of chronological age

on spatial concept development will be analyzed and compared within each of the age groups considered in the test sample.

Intelligence

Research has also indicated that intelligence may be a factor in concept development. Both intelligence and mental age have been defined in various ways and through various methods and hypotheses by investigators. In reading the literature on intelligence and concept development, the use of such terms as generalization, the ability to see relationships, abstract thinking, the ability to make inductions and deductions, and verbal ability, frequently recur.

While it has been assumed that intelligence and concept development are related, the relationship has not been worked out explicitly. There are two assumptions in research, that one of the variables of intelligence is the ability to form and use concepts, and that at least part of the reason that mental age increases during the period of growth is that the ability to conceptualize increases. Much of the research reported in the literature does not present a consistent picture.

A study by Sigel (1953) found that high-level abstract concepts like "living things" were acquired by seven year old children of average mental ability which would suggest that mental ability, as usually determined, is not crucial in the attainment of concepts.

McCullough (1943) finding children of varied intelligence rather uniformly poor in getting meaning from context clues, supposed this finding to reflect the uniform lack of attention to this skill. She did not, however, negate the importance of native ability to one's grasp of concepts. An implication was made by McCullough that direct teaching as well as intelligence can be a factor in the understanding of concepts.

Braun (1961:40) asserted that concept formation is not highly related to intelligence tests - an assertion which assumes that intelligence tests measure intelligence. Her study hypothesized that concept formation rather than intelligence was the factor most closely related to reading achievement. The conclusions drawn from her study were (1) that concept formation is relatively independent of intelligence as now measured; (2) that under-achievers of normal intelligence are deficient in concept formation ability; (3) that these children reach an "asymptote" at the end of the primary grades; (4) that growth in reading depends upon increased ability in concept formation; and (5) that use of intelligence for predicting reading achievement seems questionable since such tests do not measure concept formation ability.

This study raises several relevant questions. First, abstract thinking is defined as the ability to "manipulate symbolically without dependence on immediate concrete objects" (p. 40). On the basis of this definition, an attempt is made

to get directly at concept formation ability by reliance on verbal response. Implicit in the study is that such ability is a higher mental process dependent upon symbols, yet it is also considered separate from intelligence as presently measured. This point requires further clarification.

Another question is the cause and effect relationship between symbols and concepts in relation to the reading process. If inability to form concepts is evident only in the reading of the subject, it would seem that the cause-and-effect relationship is in doubt. Furthermore, it was found at grade three that the I.Q.-reading relationship was slightly higher than the concept formation-reading relationship. It may be speculated then that at grade three the poor reading achievement may have been due to lack of earlier direct, concrete experiences.

The findings of this study demonstrate the difficulties in measuring concepts, in discovering cause-and-effect relationships among mental processes, and the extreme dependence upon verbal response for the measurement of these processes.

With specific reference to prepositions denoting position in space, Watts (1944:41) stated that the child does not at first understand what is meant by such prepositions if his mental age is much less than four years of age, "as may be seen when he is asked to make a drawing to illustrate a nursery rhyme or fairy tale, for example, of the cow jumping over the moon, or the little mouse under the chair". Watts found

that few children below this mental age could give a correct interpretation to prepositions denoting spatial relationships.

Grigsby (1932) attempted to determine the developmental nature of concepts through the verbal expression of pre-school children at different chronological and mental ages. She reported that in so far as relations in space were concerned, terminology offered little difficulty; relational prepositions were a part of the vocabulary of these pre-school children. Under, beside, in front of, and in back of showed the highest increase in correctness with chronological age. In front of, beside, under and around had the greatest increase in correctness for mental age. Gradations of maturity in dealing with relationships were affected more by mental age than by chronological age. With increase in age, however, spatial relations expressed by these children revealed greater explicitness as well as ability to consider objects in relation to themselves without interposing the self as a point of reference. This study investigated only eight prepositions and used only one measure to determine understanding. Therefore, the findings can hardly be generalized to the understanding of all prepositions of spatial position.

Summary

It seems that intelligence is a factor in concept development in that it makes it possible for a child to benefit from experience, observe, remember, generalize and discriminate.

Efficiency of concept attainment is associated with the higher I.Q. but while the higher I.Q. children attain concepts more readily than less-bright children, children of average I.Q. do eventually have abstract as well as concrete concepts.

In this study, intelligence was also considered as a variable affecting young children's understanding of prepositions of spatial position, and hence spatial concepts.

In addition to examining total intelligence, language and non-language aspects as measured by the CTMM S-Form were considered in an attempt to obtain evidence as to whether these aspects of intelligence contributed to children's understanding of spatial prepositions.

Sex

Sex is another factor that shows some influence in concept building according to many studies. In this study it was examined as a possible factor in determining scores achieved on the Spatial Prepositions Test.

Templin (1957), studying children aged three to eight, found that the older boys in this study had achieved greater average word knowledge than the older girls, while the latter had better average articulation.

O'Donnell, Griffin and Morris (1967) found differences between the sexes in the way in which they used syntactical structures. There was a slight tendency for the girls to score

higher on the written responses and the boys to score higher on oral responses. The differences were not uniform, however, as fluctuations occurred with the scores.

In an analysis of questions recorded by mothers of children aged three to twelve years, Davis (1938) found that boys asked more questions than girls. The tendency of boys to ask more questions about certain situations may be related to their slightly superior scores on tests of general information, as these demand knowledge of concepts.

McCarthy (1930:117) reported that sex differences, although slight, were consistently in favor of the girls in language development. In studying children's use of prepositions, however, she found:

> No consistent sex differences appear in this part of speech; as there are several reversals of the direction from one age level to another.

Summary

Researchers who have considered sex differences in concept development and found differences favoring girls generally assume that these differences have cultural overtones. It has been hypothesized that girls are engaged in activities which require more verbal interaction than boys resulting in greater linguistic maturity. Such investigations, however, also seem to assume that the development of language is synonymous with the development of concepts.

Individual Differences

Research indicates that attempts to generalize about factors influencing concept development are defied by individual differences in cognitive functioning.

Sigel's (1953:141) findings showed that individual differences in ability to handle some material conceptually and to shift from perceptual to conceptual classifications are found as early as the seventh year. He concluded that it is impossible to say whether vocabulary, experience favoring concept formation, innate ability, motivational factors or personality determinants affect these abilities in children.

Different degrees of imagery among children was reported by Fennema (1959), which would affect not only the development of concepts, but the ability to hold in mind the symbols representing them.

Speech maturity has a direct bearing on meaning-getting in early reading according to Davis (1938); and the variations among children in speech at early ages is well-known.

Russell (1954) suggests that the process by which word meanings and concepts develop may be common to most children but the end product varies greatly even with children of the same age. Like Sigel, he cites the importance of motivation of the learner, emotional components, needs and tensions, in affecting progress in concept development as well as differences in the factors affecting concept development discussed above in previous sections.

Summary

These research findings would imply that the assumption cannot be made that concept development is the same for all children. If this is so, the importance of recognizing sufficiently variations in children is underscored. The findings of this study were analyzed to ascertain whether wide variations in children's spatial concept understanding existed at the levels investigated.

Materials

Several studies have suggested that written material itself contributesto the ease or difficulty with which a child develops concept understandings.

Serra (1953) stated that too much to learn on a page, and too frequent use of indefinite terms may result in inaccurate or incomplete concepts or in none at all.

A report by Sachs (1943) and others maintains that meanings are not always gained from context, whether the fault is with the difficulty of the passage, the absence of context clues, the lack of reading ability, or the lack of experience or effort on the part of the reader.

Summary

Few researchers have examined the question of problems inherent in the material with regard to concept presentation. Thus, only vague generalizations can be made which are almost

impossible to translate into practice. The need for an awareness of the nature and impact of these factors on the part of the concept builder in primary grades is indicated. Words whose meanings are not clearly understood can occur even in grade one materials.

Section Summary

Findings from a review of research on factors influencing concept development indicate that knowledge and understanding of specific concepts is closely related to background of experience and is related positively to such factors as chronological age, mental age, socio-economic level and, in some cases, sex. Research evidence further suggests that development of verbalized concepts as expressed in reading may be affected by the material read and by individual differences within the reader. As indicated previously, the various factors believed to influence understanding of concepts were given consideration in the present study in an attempt to delineate the precise significance of these factors to understanding of the concept of spatial position.

ROLE OF CONCEPTS IN READING

A conceptual response in reading is defined by Singer (1966) as an "intermodal communication system of ideas, percepts, memories and images which are mobilized to the value-

determined purposes of the individual and the stimulus-demands of the printed word". In this communication system, experiences in one modality become associated with another modality, for example, kinesthetic with visual. Holmes (1957) points out that the result can be an accumulation of developmentally acquired meanings which can be mobilized as a mediational response to printed word stimuli. Ausubel (1960) believes that a conceptual response system formed at an early age would facilitate subsequent learning and retention by serving as an "advance organizer". Thus, such a system, if initiated at the reading readiness level of instruction, would constitute the first stage in a hierarchy that could be mobilized for attaining later power and speed in reading (Singer, 1962). Ausubel's hypothesis assumes that cognitive structure is hierarchically organized in terms of highly inclusive concepts under which are included less inclusive subconcepts.

Concepts are used in interpreting words as they appear in text during reading. Research in reading suggests that there are two general levels of interpretation of stimuli, abstract and concrete, and that interpretation on an abstract level is characteristic of the good reader (Burks and Bruce (1955); Kress (1956)). Poor readers are less able to handle abstractions and since the reading process consists of abstractions which depend on memory functions, these children are handicapped.

Investigations of children's understanding of concepts

indicate that their knowledge of useful words is often incomplete in primary grades and throughout much of the elementary school, which would have an effect on performance in reading interpretation. Lacey's (1932) study of concepts of 450 children in primary grades found that concepts involving personal relationships were more difficult for these children than factual information about objects. Reading was not involved in this study as Lacey used a picture test to measure concept understanding but a study with older children by Bates (1947) reported similar results using a multiple-choice test.

Section Summary

These studies of children's concepts suggest that from the beginning of reading instruction, word meaning or concepts has an important role to play. It would seem that children as early as grade one must be aware of "extensiveness of meanings, depth or vividness of meanings, and recognition", as Bond and Bond (1943:140) have phrased three levels of meaning, on a level appropriate to their stage of development. It has been stated that word recognition by itself does not ensure understanding. It has been further stated that children must be given training in learning to think to develop varying concepts for the same words and to eventually distinguish between different levels of abstraction.

Although some of the prepositions used in the reading section of this study like up and left have multiple meanings,

only one meaning of the word, that of spatial position, was being tested. Subjects in grade one and two were dichotomized according to high and low reading achievement in each grade in order to ascertain whether the more able readers were in fact better able to demonstrate understanding of the concept of spatial position than readers with less ability.

SUMMARY OF RESEARCH STUDIES

In general, despite the numerous investigations on concept formation, the problem of young children's ideas - the ways they are formed, and children's experiences with the symbols which represent them is still not clearly understood. Much of the literature pertaining to concept development deals with only limited phases of this multi-faceted phenomena, making it difficult for the reader to arrive at a logical position.

A large proportion of the studies center around the language development of children. While both language development and concept development increase with age, they are not synonymous or equivalent to one another. Even an infant before he possesses any recognizable words may have many adequate concepts. Investigations concerning concepts therefore need to distinguish concepts from verbal responses.

Another problem lies in the "average and best children" approach of much of the research in this area. There is a

tendency to categorize behavior according to the group samples chosen by the investigator which yields a false picture of what actually occurs in the learning of a child. It can contribute to a rigid assumption that learning proceeds in strict agreement with the curriculum of grade one, grade two, etc., and there is a danger that such curriculum may become justified on the assumption that developmental changes are essentially the same for all children.

A third source of difficulty arises from the fact that experimental evidence in regard to the relationship of concept development to reading success is meager. The data available, however, suggests that there is a relationship. Investigations to measure such aspects as the relationship between experience designed to develop concepts and reading success are needed. Furthermore, the need for studies to assess the relationship between understanding of specific concepts, such as spatial relations, and reading success is indicated.

Research in the understanding of spatial relationships has largely attempted to ascertain nursery school and kindergarten children's ability to understand and use terms of spatial position. While results have indicated that these children do not fully understand such terms, little research has examined this ability in children beyond the pre-school level.

SUMMARY OF CHAPTER

Presentations in this chapter have dealt with investigations of concept development in general, spatial concept development in particular, and concepts as related to the reading process. It was indicated that verbalization assumes an important role in the acquisition of specific concepts. Factors thought to influence understanding of concepts aurally, in speech, and in reading, were included in the topics discussed.

CHAPTER III

THE EXPERIMENTAL DESIGN OF THE STUDY

The experimental design and the statistical procedures used to analyze the results of the study are outlined in this chapter. These include selection of the population and sample, a description of the tests, the pilot study, procedures for scoring the tests and method of treating data.

POPULATION AND SAMPLE

Population

The population consisted of all children from eight experimental kindergarten classes in four schools and all children enrolled in grades one and two in the Edmonton Public School System. From this population, three representative schools were chosen by personnel of the Edmonton Public School Board - one school to be used for the pilot study and the other two schools for the investigation proper.

The test sample for the main investigation was composed of 120 pupils selected randomly from the test population in the two elementary schools assigned. All pupils in the test population were considered eligible for selection in the test sample except those who were presently repeating a grade, those who had repeated a grade previously or those who had English language difficulties.

Sample

Subjects in the sample were grouped according to grade and sex. As the effects of socio-economic status were to be studied, subjects were further stratified so that half of the sample was drawn from one school and one kindergarten in an area designated by school board officials as serving families of high socio-economic status and the other half from one school and one kindergarten designated as serving families of low socio-economic status. In addition, the socio-economic status of each child in the study was rated by totalling the scores of both parents' occupations as determined on the Socio-Economic Index for Occupations, 1961 (Blishen, 1968). In cases where only one parent was the main wage-earner, that parent's score was used.

The median of the socio-economic status scores was calculated to be 30.88 for kindergarten subjects, 30.19 for grade one and 30.94 for grade two subjects. Kindergarten subjects with a score of 30.88 or more were designated as higher socio-economic status, hereafter called HSES, and a score of 30.74 or less was designated as lower socio-economic status, hereafter labelled LSES. Similarly in grades one and two, subjects with scores of 30.19, and 30.94, and above respectively, comprised the HSES groups in these grades and subjects with scores of 30.19, 30.94, and below became the component LSES groups.

Mean SES scores for all subjects in each grade by sex

are presented in Table I.

The chronological ages of the subjects were obtained from the cumulative record cards on file in the school. These ranged from 62 months to 75 months in kindergarten, from 74 months to 88 months in grade one and from 88 months to 101 months in grade two. Table I shows the mean chronological age for each of the three grades in the sample by sex.

Reading achievement grade scores of the grade one and two pupils in the study ranged from .8 to 4.9 in grade one and from 1.7 to 4.4 in grade two. A breakdown of mean grade scores in each of these grades by sex may be seen in Table I. It is noted that mean scores of boys and girls in grade one are almost identical. Moveover, they indicate a higher level of reading achievement than grade two when period of reading experience is considered. Girls' scores are higher than expected at grade two exhibiting a higher level of reading ability than boys at this level.

As indicated on Table I, the intelligence quotients of the subjects in the sample are lower in grade two than in either kindergarten or grade one. Moreover, the table shows that girls with lower intelligence quotients have reached a considerably higher level of reading achievement as tested in this study.

The mean language , non-language and total intelligence quotients of the test sample by grade and sex appear in Table II. It is interesting to note that boys in kindergarten

TABLE I

MEAN CHRONOLOGICAL AGE, SES, I.Q. AND READING ACHIEVEMENT OF SUBJECTS IN SAMPLE BY GRADE AND SEX

SUBJECT	CHRONOLOGICAL AGE (months)	SOCIO-ECONOMIC STATUS	INTELLIGENCE QUOTIENTS	READING ACHIEVEMENT (grade scores)
Kindergarten				
Boys	69.15	36.54	109.70	
Girls	69.90	34.70	102.75	
Total	69.37	35.62	106.22	
Grade One				
Boys	81.25	35.78	103.70	2.10
Girls	82.10	34.45	103.05	2.16
Total	81.62	35.11	103.37	2.13
Grade Two				
Boys	95.10	33.95	98.20	2.53
Girls	95.55	32.69	97.95	3.18
Total	95.32	33.32	98.07	2.85

TABLE II

MEAN I.Q. SCORES OF SUBJECTS AS MEASURED BY THE CALIFORNIA SHORT-FORM TEST OF MENTAL MATURITY

SUBJECTS	LANGUAGE I.Q.	NON-LANGUAGE I.Q.	TOTAL I.Q.
Kindergarten			
Boys	102.80	115.25	109.70
Girls	98.55	107.70	102.75
Total			106.22
Grade One			
Boys	99.35	106.75	103.70
Girls	97.25	107.60	103.05
Total			103.37
Grade Two			
Boys	92.60	101.20	98.20
Girls	95.30	101.70	97.95
Total			98.07

in this study scored higher in both language and non-language aspects than the girls, and boys in grade one also made slightly higher scores in the language section of the test. Greater linguistic maturity has often been attributed to girls at the time of school entrance, and it has been suggested that this is the result of girls engaging in activities which require more verbal interaction. Greater language ability, as measured by this test, was evident in the girls in grade two, however.

Selection of the sample in the two schools used for the main study was made as follows: Alphabetical class lists were obtained for all pupils in the grades involved in the study. Teachers were then asked whether any pupil listed was repeating a grade, had repeated a grade previously, or had English language difficulties. The subjects' cumulative record cards in the school were also checked for this information. The decision to exclude subjects in the above categories was made for two reasons. First, pupils repeating a grade were considered to have more experience and therefore, were thought to bias the sample. Secondly, one of the schools in particular had a large proportion of Chinese children for whom English was a second language. These children were believed handicapped in English language ability and test results obtained with them would merely reflect this disadvantage.

After deleting the names of all such pupils, final lists were prepared for each grade on a random basis from the

amended class lists. The resulting sample included twenty children from each grade, kindergarten to two inclusive, in each of two schools - a total sample of 120 subjects. Table III is a summary of the distribution of subjects within the test sample according to grade, sex, and socio-economic status. As indicated on Table III the majority of SES scores were at the lower middle end of the range of scores. An absence of grade two subjects in the highest range of SES recorded in this study is noted. Moreover, none of the subjects appear in the highest SES category on the Blishen socio-economic index.

INSTRUMENTATION

Intelligence

The investigator obtained an intelligence measure for each subject by administering the California Short-Form Test of Mental Maturity (1963) hereafter called the CTMMS-Form to groups of ten at a time prior to the study. Level 0 was administered to kindergarten subjects and Level 1 to grades one and two subjects.

Rate and scope of mental development at each level of this test is measured in terms of four factors, namely logical reasoning, numerical reasoning, verbal concepts and memory. Seven subtests within these factors are grouped into two main categories, Language and Non-Language. The test

TABLE III

DISTRIBUTION OF SUBJECTS WITHIN TEST SAMPLE

BY SOCIO-ECONOMIC STATUS

		HSES RATINGS			LSES RATINGS		
Subjects		77-71	70-61	60-51	50-41	41-31	30-25	Total
Kindergarten	Boys		2	1	2	8	7	20
	Girls				2	5	13	20
Grade One	Boys	1			5	5	9	20
	Girls			2	3	4	11	20
Grade Two	Boys			2	1	7	10	20
	Girls				2	8	10	20
Total Test Sample		3		5	15	37	60	120

yields a separate mental age and intelligence quotient for each of these sections. In addition, a total mental age and a total intelligence quotient are obtained. Copies of the CTMM S-Form, Level 0 and Level 1, are included in Appendix E.

In a review by Stanley (Buros, 1968), the CTMM S-Form is evaluated as most useful at kindergarten through grade three and progressively less useful thereafter due to its emphasis on non-verbal material. It was chosen as a means of measuring intelligence in this study because of its suitability for children in the early learning to read stages and because it provided both language and non-language scores.

Reading Achievement

A measure of reading achievement was obtained for each of the grade one and two subjects from the Gates-MacGinitie Reading Tests - Primary A and B; Level A for grade one and Level B for grade two. Each level of this test consists of two parts: Vocabulary and Comprehension. The Vocabulary Test measures the child's ability to recognize or analyze isolated words. Beginning exercises are composed of commonly used words but these gradually become less easy as the test progresses. The Comprehension Test samples the child's ability to read and understand whole sentences and paragraphs.

Reading achievement scores used in this study are an average of the sum total of the raw scores

obtained on the Vocabulary and Comprehension sections of the test.

According to Eller (Buros, 1968) test users in the field have found that the Gates-MacGinitie Reading Tests correlate well with other measures of reading ability, including appraisals by classroom teachers. The decision to employ this test to measure ability in reading was governed partly by this recommendation and partly by practical reasons. It eliminated the necessity of disrupting class routine with an additional test during a time of the school year when several other tests are given.

The Gates-MacGinitie Reading Test is normally administered to all grades one and two subjects in the Edmonton Public School System in May or June. Teachers in both schools were originally requested to submit to the investigator the scores obtained by the subjects in this study. However, as one of the schools had not received necessary test supplies in June, the investigator obtained copies of the test and administered the test to subjects in that school to avoid unnecessary delay in processing the data.

Understanding of Prepositions of Spatial Position

Demonstration Materials. Test materials used by subjects to demonstrate spatial position consisted of a model school and playground and objects to be manipulated for Subtest Sections One and Three of the test. A street encom-



passed two sides of the model. The investigator and the child sat beside each other at a table facing the front of the model and the child was free to move around anywhere he wished in order to place the objects in the position specified by the investigator.

The objects manipulated consisted of fourteen paper models and figures painted with tempera color and constructed so that they would stand when placed, and ten concrete objects which included toy representations of familiar objects found in and around a school playground, such as a ball, a see-saw and a sprinkler. In addition to their suitability to the model, manipulanda of necessity represented words introduced in grade one readers as a section of the test required that subjects first read before indicating spatial position. Examples of models and figures used are shown in the photo-

graphs in Appendix A.

A school and playground were used because it was believed that these would be familiar to all children in the sample regardless of socio-economic status. Having subjects manipulate objects to demonstrate position was thought to exercise some control over guessing.

For Section Two, a ball, a box and a hoop were the demonstration materials used. These materials were considered familiar to children going to school and were a simple and effective means of demonstrating the positions in this section of the test. The ball used was a toy football easily manipulated with one hand, and the hoop included one of the small hoops commonly used in gym classes in the schools. Photographs of these models may be seen in Appendix A.

Prepositions Tested. The criteria words used to measure the ability of the subject to understand prepositions of spatial position were obtained from the McLeod Prepositions Test. This is a non-standardized test which was developed by McLeod (1969) and administered to kindergarten subjects in a research study of the understanding of spatial prepositions at the University of Alberta.

Prepositions Test Used in this Study. Each subject was involved in an individual testing session in which the Spatial Prepositions Test, consisting of three subtest sections was administered (Appendix B). The sections were designed by the investigator to test understanding of prepositions of spatial

position by utilizing one of the following modes of stimulus-response: Verbal (Oral) — Non-Verbal, Verbal (Oral) — Verbal (Oral), and Reading — Non-Verbal. The test items in each section were not ranked in any order of difficulty but position was determined randomly. In order to clarify testing procedures and instructions and to give subjects confidence, each section began with an easy sample test item. A description of each of the test sections follows:

Verbal (Oral) — Non-Verbal Stimulus-Response Test Section. This section was designed to test the subject's aural understanding of spatial position. The subject listened to a direction given by the investigator after which he was required to manipulate objects to demonstrate the spatial position described. Objects to be used were placed in front of the child before each direction.

Example:

After placing the model of a bicycle in front of the subject, the investigator said, "Put the bicycle between the school and the fence". The subject responded by placing the bicycle in the position he believed correct. If the child hestitated, he was encouraged to respond by being asked to put the object where he thought it should be.

Verbal (Oral) — Verbal (Oral) Stimulus-Response Test Section. The purpose of this subtest was to measure children's verbalized concepts of spatial relationships in an attempt to determine whether they used prepositions precisely in describing spatial position. The investigator placed a ball or a hoop in a particular spatial position with reference to the subject, a table, a box or the box lid. The subject was then asked to describe the spatial position of the object.

An example of the type of item contained in this subtest is the following:

Position	Preposition
Ball is placed between the box and the hoop.	between

The investigator asked, "Where is the ball now?" Subject responded by describing the position orally. If no response was given, demonstration of spatial positions was repeated and the child was encouraged to try again. This subtest was first recorded on a cassette tape recorder and then transcribed to aid scoring and analysis of responses.

Reading — Non-Verbal Stimulus Response Test Section. This subtest section was designed to measure the child's ability to understand prepositions of spatial position encountered when reading. Subjects were asked to read a sentence orally and then place the object(s) in the position indicated in the sentence.

Example:

The child read, "Children are playing behind the school", and then he placed the figure in the position stated in the sentence.

This subtest section was constructed with the reading vocabulary of grade one and two children in mind. Sentences were in narrative form and words used in the sentences with the exception of prepositions, were those included in grade one readers in three authorized series* that have been in common use in the Edmonton Public School System. Estimation of the grade level of difficulty of the sentences obtained by application of The Spache Readability Formula (Spache, 1964) for readers of the first three grades, was 2.3, a level slightly above the mean grade score in reading achievement (Table I) for grade one subjects (2.1). Although there were six words not found in the Stone Revised Word List (Spache, 1964:134), four of these were prepositions and the other two were words included in at least one first grade reader. The vocabulary was further checked against the List of Words Occurring at Least Once Per 1,000,000 Words (Lorge, Thorndike, 1944) and The Word List (Buckingham, Dolch, 1936).

In the readers investigated all but three or four of the prepositions used in the test were found to be introduced

---

* The Ginn Basic Readers; The New Basic Readers; The Reading for Meaning Series.

by the end of grade two. Table IV presents in summary form the various levels at which these prepositions were introduced as new words in one reading series. The test prepositions not encountered in these readers by the end of grade two were below, beneath and underneath. In addition, the preposition outside did not appear but out and side were found as separate words.

The testing situation in this portion of the test was envisaged as an instructional independent reading activity. Thus, willingness to give assistance with words which were not recognized was expressed by the investigator but not willingness to assist with comprehension. The more fluent readers were helped to unlock words for themselves and less able readers were told what the words were when it was apparent that they did not know them. Words for which assistance was given were noted.

Children read each sentence only one time. Instances of glancing back at the sentence after reading were recorded, but this was not penalized in scoring. Subjects who hesitated and appeared to have lost the meaning of the sentence because of word difficulty were asked, "What did the sentence say?" Some responded by quoting the sentence verbatim after which placements were attempted. Others were unable to do so. Thus, hesitation in this test section did not always signify lack of knowledge or comprehension of sentences read.

TABLE IV

LEVELS AT WHICH PREPOSITIONS WERE INTRODUCED IN READERS

Levels				
Preprimer	Primer	First Reader	Second Reader	Third Reader
in	out	over	across	
	on	behind	right	
	around		front	
			top	
			above	
			beside	
			left	
			between	
			near	
			through	

2^1 (across, right, front, top, above, beside, left)

2^2 (between, near, through)

Total

Grade 1 - 6

Grade 2 - 10

16

PILOT STUDY

A pilot study was conducted in one school during March to clarify problems concerning testing procedures and instrumentation suitability. For the pilot study, five boys and five girls were selected randomly for each grade, kindergarten to grade two, yielding a total of fifteen subjects.

Subjects in this sample were grouped according to grade and sex only. The socio-economic status rating of the school used for the pilot study was deemed to be low, according to classification designated by the Edmonton Public School Board.

As a result of this preliminary study, the following changes were made:

Model

The original model school and playground included a street on two sides of the unit. As children began to manipulate objects on this model, one difficulty became apparent in such test item sentences as, "A car is on the right of the school", and "The see-saw is on the left of the school". There was a distinct tendency to demonstrate these spatial positions by placing the objects in the far right and left corners of the playground where seemingly there was more space, rather than at the sides of the building. As a result of this observation, the model playground area was enlarged and the streets were added to the "outside" of the model.

Test Format

In its original form, Subtest Section One, Verbal (Oral) — Non-Verbal Stimulus-Response consisted of sentences stated in imperative form; e.g., "Put the sign above the door". Because the sentences which the children read in Section Three of the Spatial Prepositions Test were in narrative form, it was decided to change the form of the sentences in this section into similar form so that the stimuli would be identical for these two parts of the test, Sections One and Three.

It was observed that a child was often able to demonstrate a correct position in the Verbal (Oral) — Verbal (Oral), and Reading — Non-Verbal Stimulus-Response sections of the test even though there had been initial hesitation in deciding where to make a placement. This reticence on the part of the child was followed up by questioning the meaning of the preposition (beneath, below, etc.). In some instances, the response given was, "I don't know", indicating that the answer shown by demonstration may have been a guess. Since an oral response from the child was not required in these test sections, it was felt that the child should be given credit in the main study as long as the correct placement was made. However, it was decided to follow up evidence of uncertainty displayed by subjects by questioning in the first subtest section given each child and inability to verbalize and to render an explanation of the correct meaning of the preposition was noted.

Test items, questioning techniques and scoring methods were considered to be functioning satisfactorily and therefore were unchanged in the final revision of the test.

A copy of the Spatial Prepositions Test and directions for administering are included in Appendix B.

DATA COLLECTION

The final form of the test was administered to a sample of 120 subjects during April and May, 1970. Subjects were tested individually in a room provided by the school and with only the investigator present. The time required for each test varied from twenty to thirty minutes for kindergarten children and from thirty to forty minutes for children in grades one and two. As the subject entered the testing room, the investigator discussed the model briefly with the subject, tried to put him at ease by letting him handle the microphone and speak into it, and administered a sample question to clarify directions. Children were fascinated by the manipulanda which thus provided interest and motivation during testing.

All sections of the test were administered under comparable conditions. To guard against one section of the test providing clues to other sections of the test, testing procedures were administered so that each grade began with a different section. In addition, within each grade, half

of the subjects were given the test sections in a different order from the other half of the subjects. The order was determined in the following manner. Kindergarten subjects began with Section One, the oral — non-verbal section, grade one began with the oral — oral section, Section Two, and grade two subjects with Section Three, the reading — non-verbal section. Other sections of the test followed in sequence.

Example:

In grade two the children were divided into two groups of twenty and they took their tests in the order indicated below:

Group 1	Group 2
Reading — Non-Verbal	Verbal (Oral) — Verbal (Oral)
Verbal (Oral) — Verbal (Oral)	Verbal (Oral) — Non-Verbal
Verbal (Oral) — Non-Verbal	Reading — Non-Verbal

The possible strong order effect suggested by this arrangement of test sections across the grades did not materialize due to inconvenience in testing. Because of the limited space provided in both schools, the model school and playground was set up in a different room from the ball, box, hoop and cassette equipment. Hence, when the child was given the Verbal (Oral) — Non-Verbal portion of the test using the model school and playground, it seemed more efficient to then

give the other section the Reading — Non-Verbal as well. The order of these two parts of the test, however, was varied for each half of the subjects in a grade group.

THE SCORING

The subject's responses were recorded in writing as they were given in a prepared data collection booklet, and were later scored. The methods used to assess the subject's performance on each of the test sections were as follows:

In the Verbal (Oral) — Non-Verbal subtest section, subjects' responses were scored as either correct, partially correct or incorrect. If the correct response was given, a score of 2 was assigned. If the incorrect response was given, the subject received a score of 0. Part of the stimulus was repeated in statement form after each placement was made, whether such placement was correct or incorrect. If subsequent to this repetition, a child who had made an incorrect placement initially, changed the object(s) to the correct position, a score of 1 was assigned. A maximum score of 40 was possible for each of these sections with this system of scoring.

Example:

<u>Verbal (Oral) — Non-Verbal Section</u>

The investigator said, "A car is on the right of the school". Show me where it is. The child placed the toy car

in front of the school, across the street. The investigator said, "That's on the right of the school". The child then either changed the position of the car, sometimes to another incorrect position, nodded, or replied in the affirmative.

Verbal (Oral) — Verbal (Oral) Section

A different system of scoring was employed in the Verbal (Oral) — Verbal (Oral) subtest section. Responses were first divided into three categories: correct response, plausible and partial response, and incorrect response. In an attempt to distinguish levels of precision reached by the subjects in their responses, correct responses were recorded only if the child used the correct preposition. Plausible responses, partial responses and incorrect responses were also noted.

Example:

Examiner places the ball beside the box.

Examiner: Where is the ball now?

Children's reply: Beside the box = Correct
By the box, at the box = Plausible
On the box = Incorrect.

An example of a partial response is the following:

Examiner places the ball above the child's head.

Examiner: Where is the ball?

Child's reply: Above (partial response).

Examiner: Above? Above what?

Child's reply: Above my head.

As performance on this section was to be compared with the other test sections, correct responses were further designated by a score of 2 and incorrect responses by a score of 0. Plausible and partial answers were assigned a score of 1 as these were considered to be some evidence of comprehension of prepositions of spatial position - the information sought in this study, even though ability to use the correct preposition precisely and spontaneously was not demonstrated. The maximum possible score for this section was also 40.

Reading — Non-Verbal Section

Scoring and procedure was similar to the Verbal (Oral) — Non-Verbal section except that the child first read each sentence orally.

Total test scores of the subjects in kindergarten, grades one and two were tabulated for the Verbal (Oral) — Non-Verbal and Verbal (Oral) — Verbal (Oral) sections of the Spatial Prepositions Test and total scores of grade one and two subjects for the Reading — Non-Verbal test section.

Two independent scorers (primary teachers) were directed to score four test booklets from each grade randomly selected. Interjudge reliability was calculated using the Arrington (Feifel and Lorge, 1950:5) formula. Percentages of agreement were found to be 92% on the Verbal (Oral) — Non-Verbal stimulus-response section, 92% and 95% on the Verbal (Oral)

— Verbal (Oral) stimulus response test section and 92% and 95% on the Reading — Non-Verbal mode of stimulus response portion of the test.

STATISTICAL ANALYSIS OF DATA

Subjects' responses on the Spatial Prepositions Test were processed by statistical measurement with consideration given to the variables of sex, socio-economic status, intelligence, chronological age and reading achievement. Interactions of variables and effects on scores achieved were determined. In all of the analyses conducted, the .05 level of significance was adopted by the investigator.

A three-way analysis of variance with one repeated measure was used to analyze the portion of the data representing total scores of kindergarten, grade one and two subjects on each stimulus-response section. Verbal (Oral) — Non-Verbal and Verbal (Oral) — Verbal (Oral) responses comprised the repeated factor. The same analysis was used to determine differences between total scores on the Reading — Non-Verbal test section for grades one and two subjects, with the Reading — Non-Verbal stimulus-response test section a repeated factor.

The relationship between the subject's scores on the understanding of prepositions of spatial position and the variables of intelligence, chronological age, socio-economic status and reading achievement were considered by computing

and examining the correlation coefficients between the scores and these variables.

To ascertain the difficulty level of the prepositions tested, an analysis was carried out by hand by the investigator using a z test of differences between proportions within each mode and between modes of stimulus-response test sections.

SUMMARY

This chapter contained an explanation of the procedures and methods employed to investigate the problem. Included were a description of the subjects used in the test sample and the details of the construction, administering, and scoring of test instruments involved in the collection of the data. A brief outline of the statistical means employed to analyze the data concluded the chapter.

CHAPTER IV

ANALYSES OF DATA AND FINDINGS OF THE STUDY

The purpose of this chapter is to present the analyses of the data and findings of the study under the following headings:

I Performance of Kindergarten, Grades One and Two Subjects on Two Modes of Stimulus-Response Sections of the Spatial Prepositions Test.

II Performance of Grades One and Two on Third Mode of Stimulus-Response Section of the Spatial Prepositions Test.

III Correlational Analyses.

IV Analyses of Variance.

V Comparison of Difficulty Level of Prepositions of Spatial Position.

VI Additional Findings and Test Observations.

VII Summary

PERFORMANCE OF KINDERGARTEN, GRADES ONE AND TWO SUBJECTS ON TWO MODES OF STIMULUS-RESPONSE TEST SECTIONS

The results of each subject's performance on the Verbal (Oral) — Non-Verbal and Verbal (Oral) — Verbal (Oral) modes

of stimulus-response test sections were subjected to a three-way analysis of variance according to program ANOV 3Ø, with mode of stimulus-response a repeated factor. The variables of sex, grade, socio-economic status, intelligence, reading achievement and chronological age were examined to determine if there was a significant difference in pupil performance in the light of these variables. Performance on the third mode of stimulus-response section of the Spatial Prepositions Test will be examined in the next section of this chapter. This is the Reading — Non-Verbal test section.

Table V presents, in addition to the mean scores for each grade, the standard deviations and difference of means for each mode of stimulus-response test section. Mean scores obtained by subjects in two modes of stimulus-response sections disclosed the progressive ability of pupils from kindergarten to grade two to demonstrate understanding of prepositions of spatial position using each mode. The total possible score for each of these two portions of the Spatial Prepositions Test was 40. The mean grade scores were as follows:

Verbal (Oral) — Non-Verbal - kindergarten, 25.50; grade one, 30.97; grade two, 31.52.

Verbal (Oral) — Verbal (Oral) - kindergarten, 17.57; grade one, 18.85; grade two, 23.00.

The test mean of 25.50 for the kindergarten pupils in the Verbal (Oral) — Non-Verbal stimulus-response section indicates that these subjects were able to correctly demon-

TABLE V

PERFORMANCE OF PUPILS ON SPATIAL PREPOSITIONS

TEST SECTIONS BY GRADE

Subjects by Grade	PUPIL PERFORMANCE ON TEST SECTIONS						DIFFERENCE OF TEST SECTION MEANS		
	V(ORAL) — NON-VERBAL		V(ORAL) — V(ORAL)		READING — NON-VERBAL				
	Mean Scores 40/40	Standard Deviation	Mean Scores 40/40	Standard Deviation	Mean Scores 40/40	Standard Deviation	V(O)-N.V. and V(O)-V(O)	V(O)-N.V. and Rdng. N.V.	V(O)-V(O) and Rdng. N.V.
K	25.50	4.70	17.57	5.12			7.93		
1	30.97	4.47	18.85	5.08	26.02	5.84	12.12	4.95	7.17
2	31.52	4.13	23.00	4.89	30.12	4.77	8.52	1.40	7.12

strate the meaning of approximately 64% of the spatial prepositions tested. It is difficult to assess the adequacy of this performance in view of the paucity of previous research. However, McLeod's (1969) research found that kindergarten pupils could demonstrate understanding of 75% of the same prepositions in a similar non-verbal situation. This might suggest that the performance of the subjects in the present study was below the level expected of pupils at this stage. The 77% and 79% of spatial prepositions demonstrated at successive grade levels might also be considered inadequate according to results projected from McLeod's kindergarten study.

In the Verbal (Oral) — Verbal (Oral) test portion, the mean score of 17.57 for pupils in kindergarten would seem to indicate a generally high level of performance when compared with the mean score of 18.85 for grade one subjects. Higher scores might have been expected from grade one pupils who have had an additional year in school. In addition, approximately half of the grade one subjects tested had been in an experimental kindergarten class the previous year which should have given these subjects another advantage. Although the mean score of 23.00 for grade two in this test section shows an increase of 10% over grade one performance, it represents accurate verbal description of only 57% of the prepositions as tested in this study. The assumption might be made that this is inadequate achievement when it is considered

that the majority of these pupils have encountered at least 80% of the prepositions in their reading program.

An examination of the mean scores across the grades reveals that pupils scored higher on the Verbal (Oral) — Non-Verbal stimulus-response section than on the Verbal (Oral) — Verbal (Oral) stimulus-response portion. The greatest difference in test scores is indicated between grades one and two subjects for the Verbal (Oral) — Verbal (Oral) stimulus-response section and between kindergarten and grade one subjects for the Verbal (Oral) — Non-Verbal stimulus-response. Figure I illustrates these differences graphically. It would seem that there is little or no apparent difference in the performance of pupils in employing prepositions of spatial position accurately in speech before grade two. An increase in ability to comprehend these terms aurally however is demonstrated earlier, at the grade one level. But whereas ability in oral comprehension of prepositions of spatial position (Verbal (Oral) — Non-Verbal stimulus-response section) appears to be levelling off after grade one, ability to use these terms accurately in describing position seems rather to increase considerably at this stage. The apparent levelling-off may simply reflect the attention being given to the other two modes of stimulus-response by the child.

McLeod attributed greater success on the non-verbal test section to the availability of cues in this section provided in the context in which the preposition was given in the

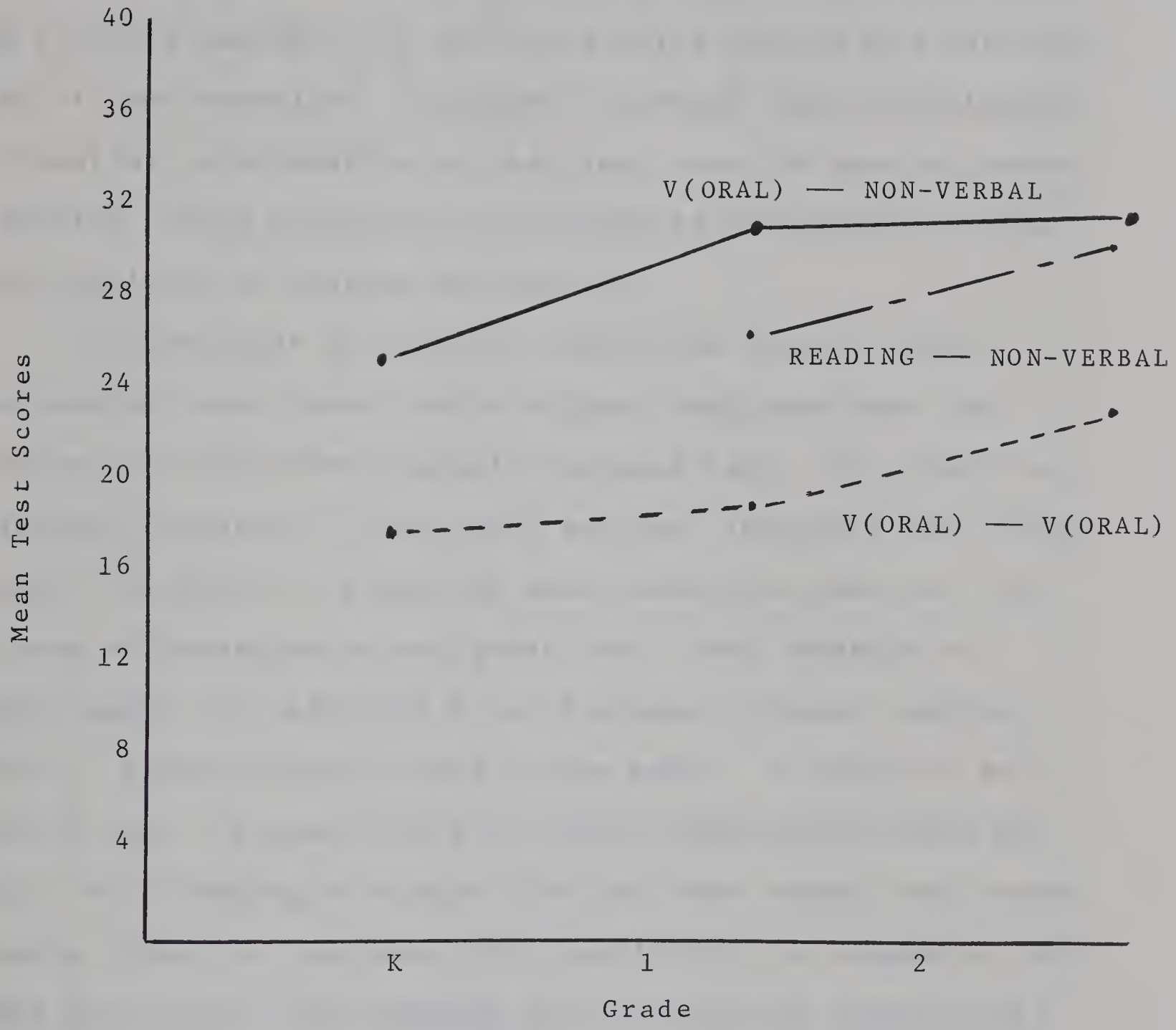
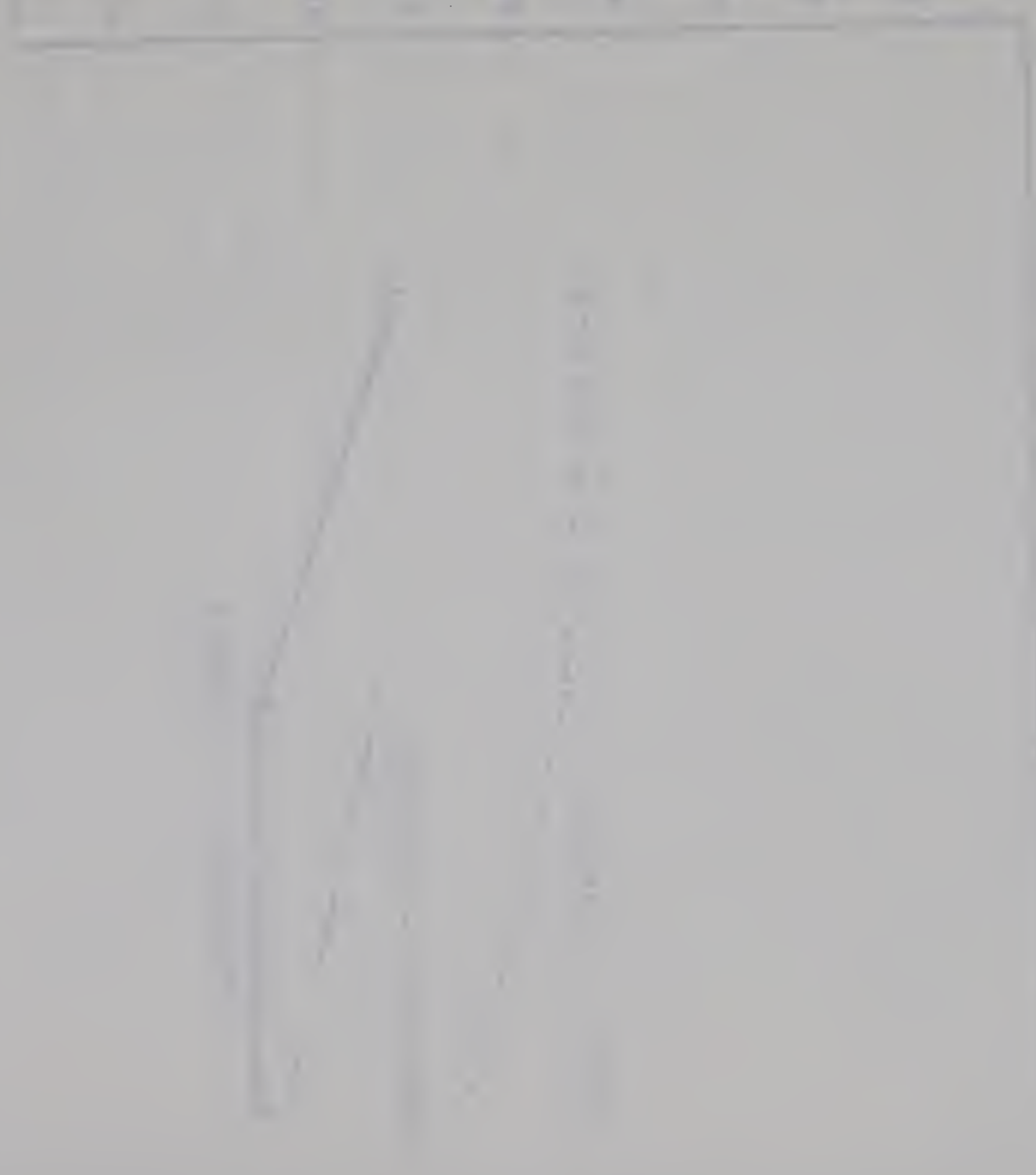


FIGURE I

PUPIL PERFORMANCE ON SPATIAL PREPOSITIONS TEST BY STIMULUS-RESPONSE SECTIONS ACROSS THE GRADES



sentence. It seems logical to assume that the oral context supplied by a phrase such as "on the bicycle" may have served as a verbal mediator for the child which facilitated the solving of test questions. Sonquist and Kamii list verbalization of spatial relationships as the final level of spatial understanding, being preceded by the level of recognition of spatial position of objects non-verbally.

The decrease in standard deviations noted at each successive grade level, while slight, indicates that the variability of scores gradually becomes less. The grade two standard deviation in each mode section, indicates that these pupils' scores were closer to mean dispersion than were the scores of kindergarten and grade one. Thus, aspects of development are indicated by an increase in means, and by pupils' scores coming closer to the mean. It might be expected that a longer period of school experiences would result in a widening of scores from the mean rather than scores coming closer to the mean. The possibility is suggested that this may reflect the tendency of the school to teach to the majority instead of employing differentiated instruction in accordance with the need of the individual child.

Table VI presents the frequency distribution of the test scores for each of kindergarten, grades one and two pupils by mode section and Figures II, III, and IV, graphically depict this distribution across the grades. The distribution reveals a general increase in the frequency of

TABLE VI

FREQUENCY DISTRIBUTION OF PUPIL SCORES ON THE SPATIAL PREPOSITIONS TEST BY MODE AND BY GRADE

RANGE OF SCORES	KINDERGARTEN		GRADE ONE			GRADE TWO		
	MODE		MODE			MODE		
	V(O)-N.V.	V(O)-V(O)	V(O)-N.V.	V(O)-V(O)	Rdng.-N.V.	V(O)-N.V.	V(O)-V(O)	Rdng.-N.V.
0-5	0	1	0	1	0	0	0	0
6-10	0	2	0	0	1	0	1	0
11-15	2	12	0	5	1	0	2	1
16-20	3	11	1	22	4	0	5	0
21-25	9	13	4	8	9	5	22	5
26-30	22	1	13	4	17	6	9	14
31-35	4	0	14	0	7	24	1	16
36-40	0	0	8	0	1	5	0	4
Total	40	40	40	40	40	40	40	40

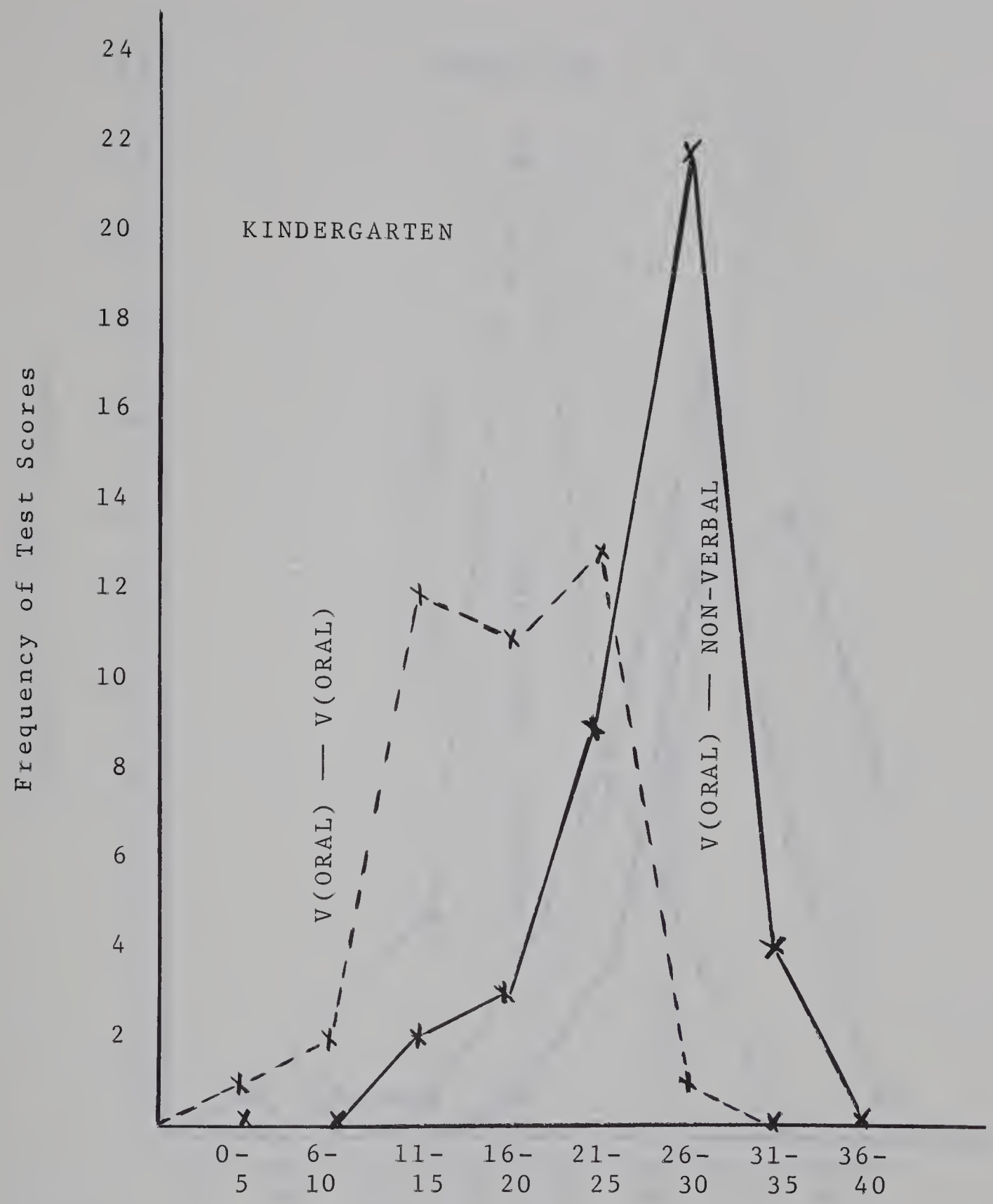


FIGURE II

DISTRIBUTION OF SCORES ON THE SPATIAL PREPOSITIONS TEST IN KINDERGARTEN



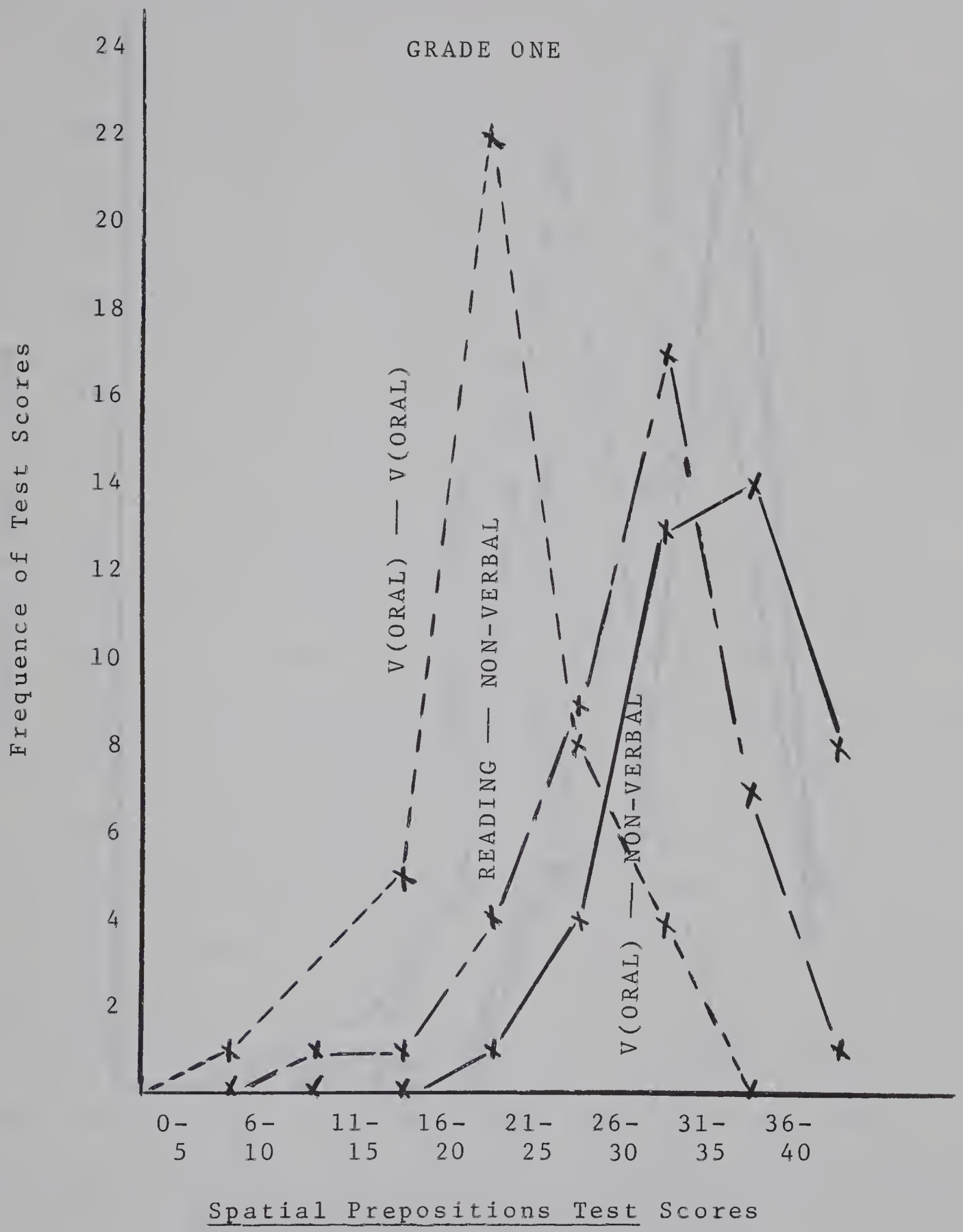


FIGURE III

DISTRIBUTION OF SCORES ON THE SPATIAL PREPOSITIONS TEST IN GRADE ONE

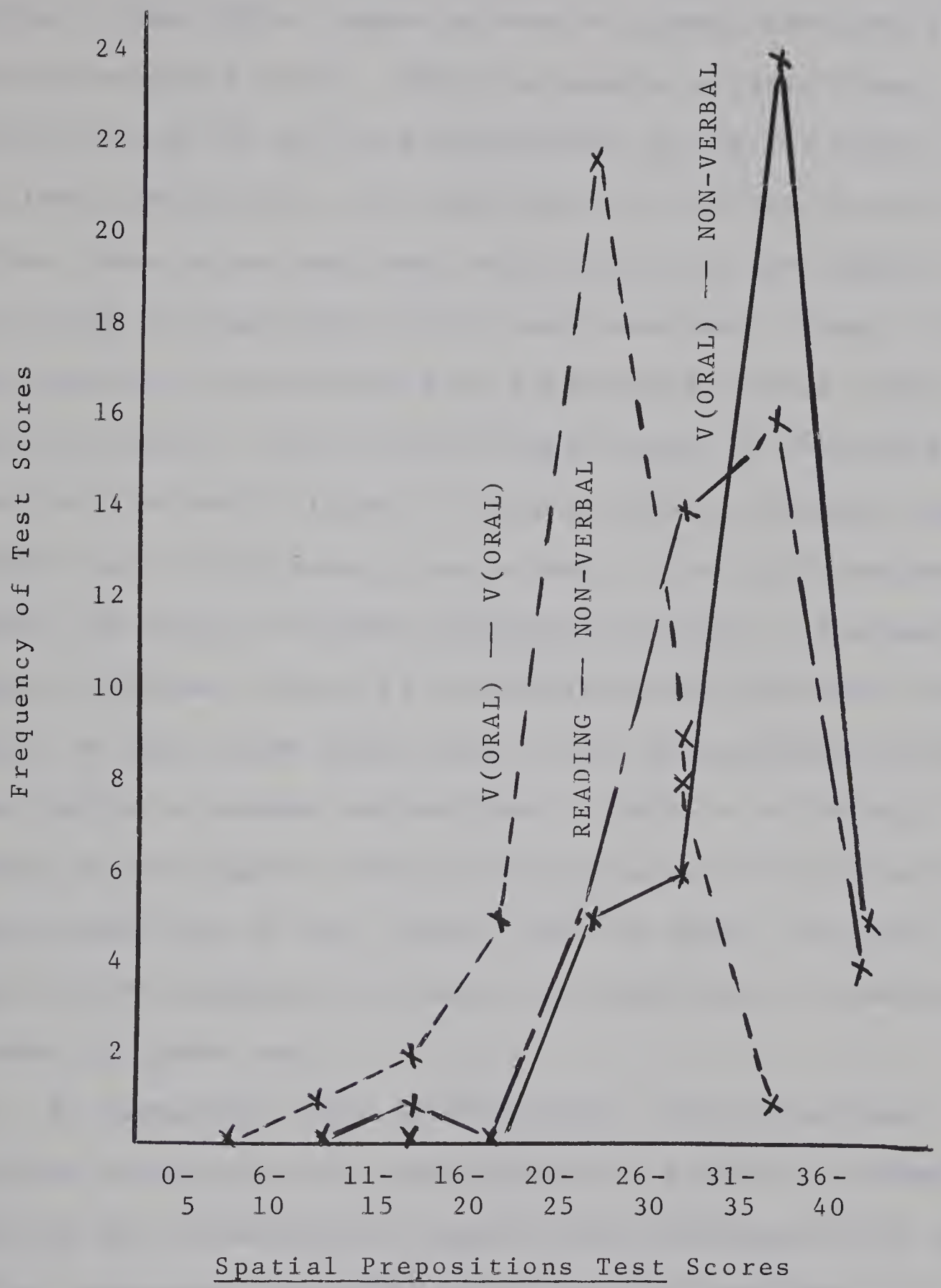


FIGURE IV

DISTRIBUTION OF TEST SCORES ON THE SPATIAL PREPOSITIONS TEST IN GRADE TWO



scores in the higher range intervals in mode sections at each successive grade level. This represents a score range of 19 (13-32) and 21 (5-26) in kindergarten in the two modes test sections; 18 (20-38), 28 (2-30), and 26 (10-36) in grade one in the three modes sections; and 17 (21-38), 24 (10-34), and 24 (14-38) in grade two in the test sections. Thus, children vary greatly in performance as evidenced by these range intervals of scores. The greatest range occurs at the grade one level in the Verbal (Oral) — Verbal (Oral) stimulus-response section but the extremely low score of 2 in this section widens the range of scores disproportionately. The smallest range of scores, 19 and 21 in kindergarten indicates that pupils at this grade level were a more homogeneous group than were pupils in grades one and two. There is an absence of scores in the highest range in kindergarten in both mode sections tested and in the lowest range in grade two which suggests development from less understanding in kindergarten to more in grade two.

To summarize, mean grade scores, test variations, standard deviations and range of scores indicate a general increase in the ability of pupils from kindergarten to grade two to understand prepositions of spatial position.

Pupil Performance by Sex

A breakdown of mean scores and difference of means for boys and girls on each mode of stimulus-response section is

given in Table VII. Although boys in each grade performed consistently better on the Verbal (Oral) — Non-Verbal stimulus-response section the differences were small. Girls in kindergarten and grade two tended to score higher on the Verbal (Oral) — Verbal (Oral) stimulus-response portion of the test but the differences were minimal from section to section. The greatest difference in mean scores is revealed at the grade two level in the Verbal (Oral) — Non-Verbal stimulus-response section with boys demonstrating a better performance. This might suggest that boys at this level have greater understanding of the meaning of prepositions of spatial position and can demonstrate this understanding when an oral language response is not solicited. When the verbal label was required as in the Verbal (Oral) — Verbal (Oral) stimulus-response section, however, boys were no more competent than the girls.

These findings are contrary to those of a similar study by McLeod (1969) and as indicated by other researchers (Luria, 1959; McCarthy (1954)). However much of the previous research in this area including that of McLeod has been carried out with younger children than the majority of the subjects included in this study. The findings of the present study are in agreement with the results obtained by McCarthy (1930:117) when children's use of prepositions was studied. She found "no consistent sex differences in this part of speech as there are several reversals of the direction of the differ-

TABLE VII

PERFORMANCE OF BOYS AND GIRLS ON

SPATIAL PREPOSITIONS TEST SECTIONS BY GRADE

Subjects by Grade	PUPIL PERFORMANCE ON TEST SECTIONS: V(ORAL) — NON-VERBAL Mean Scores 40/40	V(ORAL) — NON-VERBAL Difference of Means	V(ORAL) — V(ORAL) Mean Scores 40/40	V(ORAL) — V(ORAL) Difference of Means	READING — NON-VERBAL Mean Scores 40/40	READING — NON-VERBAL Difference of Means
K Boys (N=20)	26.00		17.35			
Girls (N=20)	25.00	1.00	17.80	.45		
1 Boys (N=20)	31.40		18.95		25.55	
Girls (N=20)	30.55	.85	18.75	.20	26.50	.95
2 Boys (N=20)	32.45		22.75		29.35	
Girls (N=20)	30.60	1.85	23.25	.50	30.90	1.55

ence from one age level to another". Although the subjects used by McCarthy in her study ranged in age from one and a half years to five years of age only, it appears that a similar situation exists with older children.

Pupil Performance by SES

In order to ascertain whether SES was a factor in scores achieved on the Spatial Prepositions Test, the grades in the sample were each divided into two component groups of higher and lower SES, and an analysis of pupil performance was carried out. These SES groups and their mean scores appear in Table VIII. The indication is that while higher SES pupils were generally able to perform better on each of the two stimulus-response test sections in each grade, the differences were small. An exception to the slightly higher general trend for these pupils is noted in grade two for both mode portions examined where the mean scores of the lower SES group (31.85 and 23.25) were as good as or better than those of the higher SES pupils (31.20 and 22.75). This might suggest that after almost two years of experience in school, the influence of the socio-economic variable by itself is not as great a contributing factor to children's ability to understand prepositions of spatial position. It may be that the education of the parents and the home environment are no longer as influential in this aspect of development and school experiences and instruction may be contributing more.

TABLE VIII

PERFORMANCE OF PUPILS ON SPATIAL PREPOSITIONS

TEST SECTIONS BY SES

Subjects by Grade	Mean SES Ratings	PUPIL PERFORMANCE ON TEST SECTIONS: V(ORAL) — NON-VERBAL Mean Scores 40/40	V(ORAL) — NON-VERBAL Difference of Means	V(ORAL) — V(ORAL) Mean Scores 40/40	V(ORAL) — V(ORAL) Difference of Means	READING — NON-VERBAL Mean Scores 40/40	READING — NON-VERBAL Difference of Means
K HSES (N=20)	40.11	26.10		18.70			
LSES (N=20)	29.14	24.90	1.20	16.45	2.25		
1 HSES (N=20)	41.24	32.00		20.30		26.70	
LSES (N=20)	28.94	29.50	2.50	17.40	2.90	25.35	1.35
2 HSES (N=20)	37.39	31.20		22.75		29.75	
LSES (N=20)	29.25	31.85	.65	23.25	.50	30.50	.75

School has perhaps become a leveller for pupils at this stage, in that it is providing what is needed for lower socio-economic pupils, but in so doing is not extending development in this area for higher socio-economic subjects.

Across the grades, it can be seen that a greater discrepancy exists between scores of higher and lower socio-economic status subjects in grade one than among these groups in kindergarten and grade two. The difference of means in performance between groups for grade one is 2.50 compared to 1.20 for kindergarten and .65 for grade two. When the difference of mean SES ratings for each grade are calculated from Table VIII, the difference for grade one is also greater than those of kindergarten and grade two pupils (12.30 as compared to 10.97 and 8.14), but the difference is not great.

Pupil Performance by Total I.Q.

Children with intelligence quotients of 100 or above in grades one and two and those with ninety-eight and above in kindergarten obtained better results than did their counterparts with intelligence quotients of 100 and ninety-eight, or below. Upon considering the mean scores for each I.Q. group in each grade, Table IX, and as depicted graphically across grades in Figure V, it will be noticed that a substantial gain was made between higher and lower I.Q. groups for each of the two modes of stimulus-response test sections. This

TABLE IX

PERFORMANCE OF PUPILS ON SPATIAL PREPOSITIONS

TEST SECTIONS BY TOTAL I.Q.

Subjects by Grade	Mean I.Q.	PUPIL PERFORMANCE ON TEST SECTIONS: V(ORAL) — NON-VERBAL		V(ORAL) — V(ORAL)		READING — NON-VERBAL	
		Mean Scores 40/40	Difference of Means	Mean Scores 40/40	Difference of Means	Mean Scores 40/40	Difference of Means
K H I.Q. (N=20)	119.80	26.65		19.40			
L I.Q. (N=20)	92.70	24.35	2.30	15.75	3.65		
1 H I.Q. (N=20)	113.40	33.05		21.60		28.40	
L I.Q. (N=20)	93.35	28.90	4.15	16.10	5.50	23.65	4.75
2 H I.Q. (N=20)	103.15	32.90		25.05		31.85	
L I.Q. (N=20)	93.00	30.15	2.75	20.95	4.10	28.40	3.45

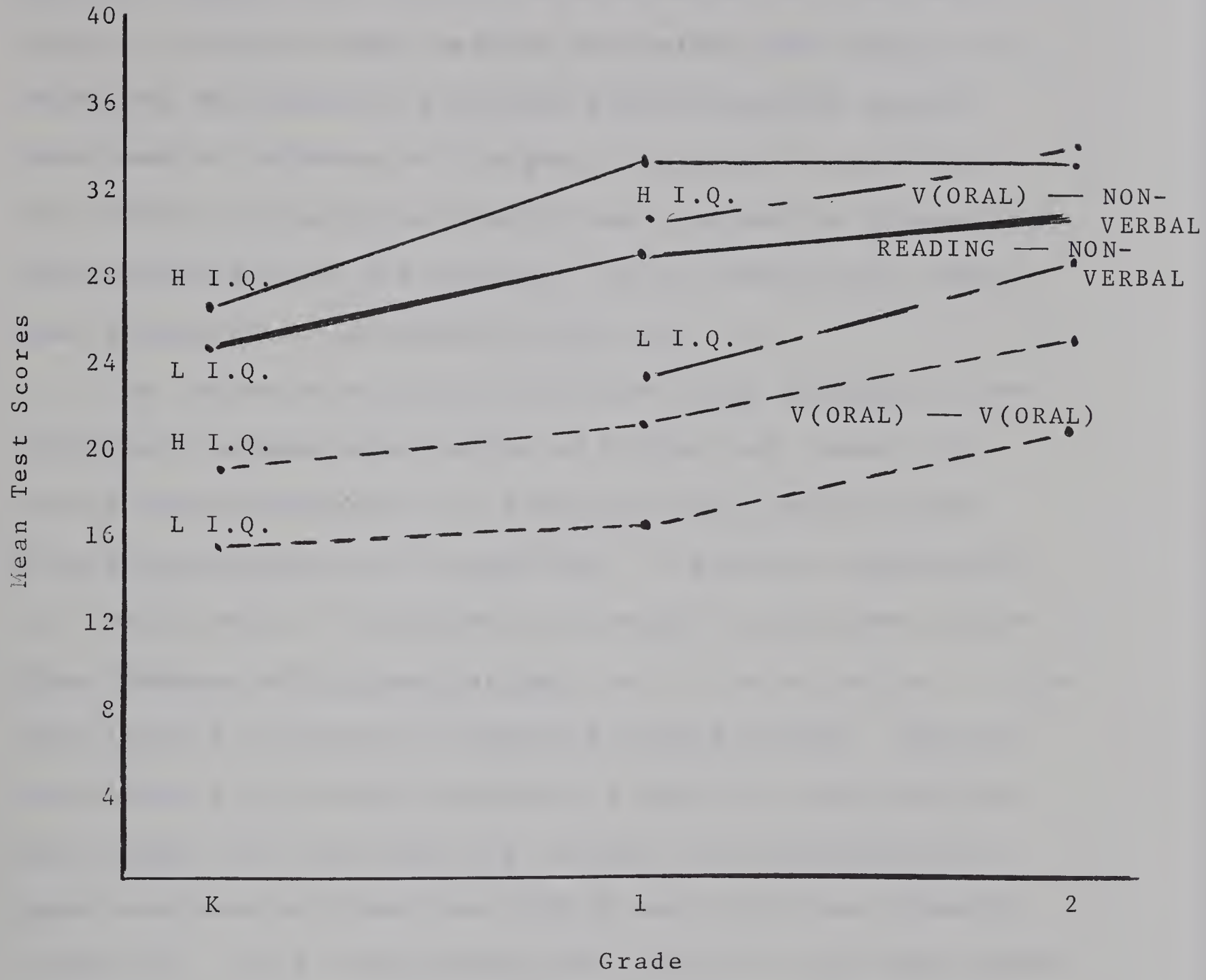


FIGURE V

PUPIL PERFORMANCE ON SPATIAL PREPOSITIONS TEST

BY TOTAL I.Q. ACROSS THE GRADES



gain for higher I.Q. groups was more marked in the Verbal (Oral) — Verbal (Oral) section indicating that ability to verbalize the concept of spatial position may be better developed in children with higher intelligence quotients. The ability to recognize spatial position and to demonstrate understanding of it non-verbally, on the other hand, may be less dependent on intelligence factors.

As indicated on Table IX, there is an increase in the difference between mean scores of higher and lower I.Q. groups from kindergarten to grade one but a drop in mean scores from grade one to grade two. A possible explanation for the decrease in difference of means of grade two scores when compared with grade one may lie in the variation in the intelligence quotients of pupils in these grades. The mean intelligence quotients, as shown in Table IX, are considerably higher for the upper I.Q. groups in kindergarten and grade one than in grade two (119.80 and 113.40 as compared to 103.15). It is interesting that there is a greater difference between pupil performance of high and low I.Q. groups in grade one even though the high I.Q. group in kindergarten had initial higher intelligence quotients. This may be a reflection of the influence of the school for grade one pupils.

As shown previously, when consideration was given to SES, the differences between mean scores of high and low groups were not great, 2.90 in the Verbal (Oral) — Verbal (Oral) stimulus-response section in grade one being the

greatest difference. Hence, the difference of means of 5.50 for groups in grade one in this section when intelligence was considered suggests that this factor, total I.Q., may be contributing to the spread in scores.

In an attempt to discover where the area of significance with respect to low and high intelligence occurred, intelligence scores obtained on the CTMM S-Form were broken down into scores for the two main sections which compose the test, namely Language and Non-Language. Language and Non-Language scores were then further sub-divided into high and low achievers for purposes of comparison.

Pupil Performance by Language I.Q.

Table X shows the mean performance of pupils in the test sample when consideration was given to language I.Q. groups in each grade. Findings reveal that children with high language intelligence quotients scored higher on both of these aspects of the test than did children with low language intelligence quotients. It is of considerable interest that although the greatest range in mean language I.Q. occurs in kindergarten the difference between performance scores for these high and low language I.Q. groups is smallest. Moreover, while the overall scores for the Verbal (Oral) — Non-Verbal test section are considerably higher, the variation between scores of high and low language I.Q. achievers in each mode portion in kindergarten is almost identical, 2.55

TABLE X

PERFORMANCE OF PUPILS ON SPATIAL PREPOSITIONS

TEST SECTIONS BY LANGUAGE I.Q.

Subjects by Grade	Mean Language I.Q.	PUPIL PERFORMANCE ON TEST SECTIONS: V(ORAL) — NON-VERBAL		V(ORAL) — V(ORAL)		READING — NON-VERBAL	
		Mean Scores 40/40	Difference of Means	Mean Scores 40/40	Difference of Means	Mean Scores 40/40	Difference of Means
K High I.Q.-L	117.30	26.80		18.85			
Low I.Q.-L	85.85	24.20	2.60	16.30	2.55		
1 High I.Q.-L	108.45	33.80		20.90		29.00	
Low I.Q.-L	88.15	28.15	5.65	16.80	4.10	23.10	5.90
2 High I.Q.-L	100.60	32.00		24.75		31.40	
Low I.Q.-L	86.50	31.05	.95	21.25	3.50	28.85	2.55

and 2.60. Thus, language I.Q. is not suggested as an important factor in test scores achieved by kindergarten subjects in this study.

It must also be noted that in grade two the difference in scores achieved by the two groups on the Verbal (Oral) — Non-Verbal section is minimal, only .95. Thus, for grade two subjects, competence in langugage as measured by CTMM S-Form is indicated as a possible influential factor only in the Verbal (Oral) — Verbal (Oral) stimulus-response section of the test.

The pictorial representation in Figure VI reveals that developmental aspects relative to the ability to understand prepositions of spatial position in higher and lower language I.Q. groups are generally indicated by the higher level of pupil performance in each successive grade in each mode section. Scores produced by the high language I.Q. group in grade one however exceed those of the high language I.Q. pupils in grade two and thus are an exception to the general trend. A possible reason for this may be the higher mean language intelligence quotients (108.45) of the upper group in grade one as compared to its counterpart in grade two (100.60). As indicated in the figure, the greatest difference between the scores of high and low language I.Q. groups across the grades occurred between kindergarten and grade one in both test sections.

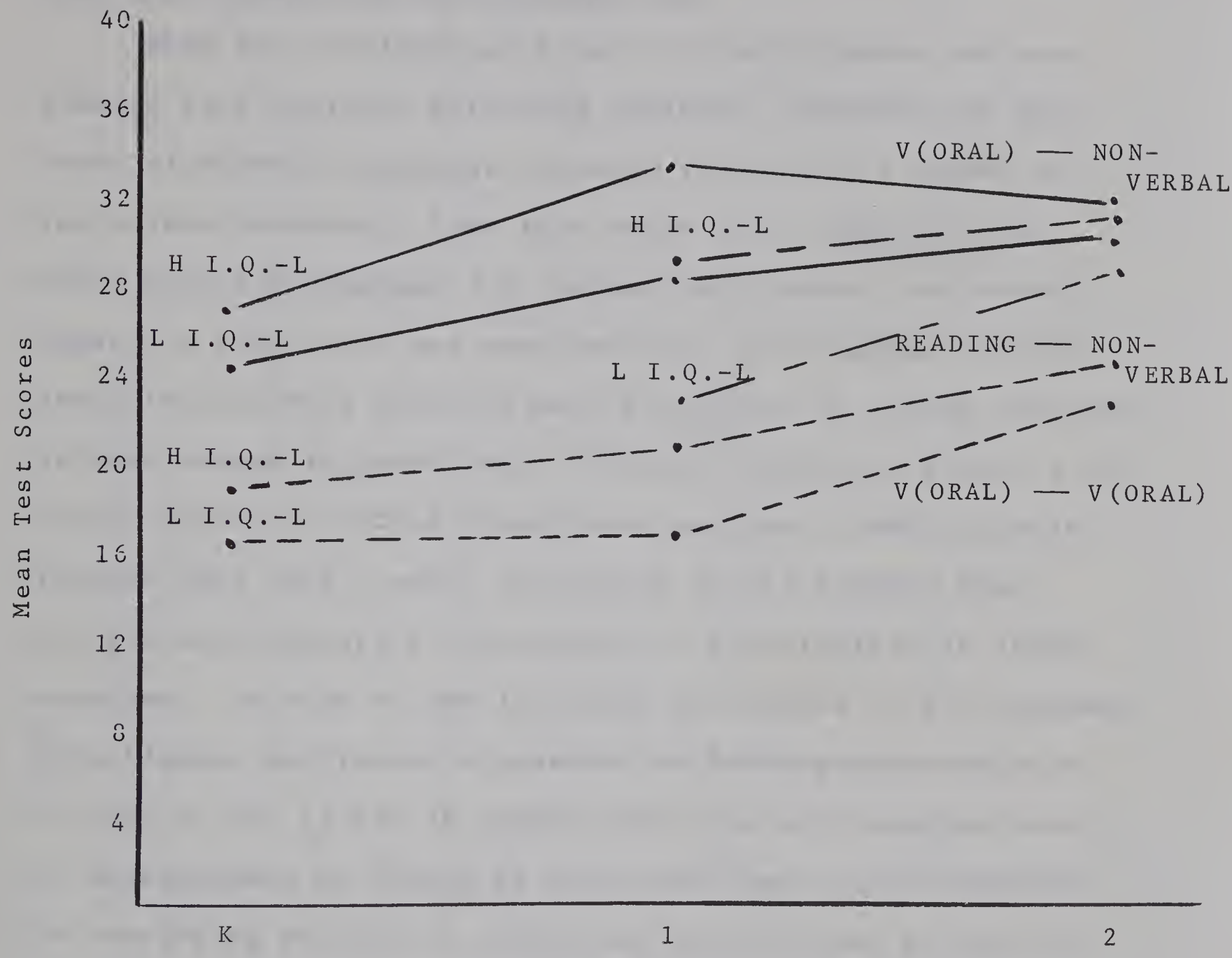


FIGURE VI

PUPIL PERFORMANCE ON SPATIAL PREPOSITIONS TEST

BY LANGUAGE I.Q. ACROSS THE GRADES



Pupil Performance by Non-Language I.Q.

When the non-language aspect of intelligence was considered as a variable affecting subjects' responses on two modes of stimulus-response sections (Table XI) a number of facts were revealed. From this table it is apparent that while high non-language I.Q. groups have scored consistently higher in each grade and mode section, non-language intelligence factors have made the most difference in scores achieved between groups in grade one, with more difference shown in the Verbal (Oral) — Verbal (Oral) test section. Table XI also reveals that only a small difference exists between high and low non-language I.Q. subjects in kindergarten in scores obtained. In view of the fact that the spread in non-language intelligence quotients is greatest in kindergarten subjects (28.45: 21.65, 11.65) it appears that the non-language aspects of intelligence as tested in this study may not be operative in developing ability to understand prepositions of spatial position in these pupils. The scores of grade two appear to be affected only in the Verbal (Oral) — Verbal (Oral) stimulus-response section and the effect is less than that found in grade one in the same test. Figure VII illustrates in graph form the effect of non-language intelligence factors on test scores achieved across the grades. As evident in the figure, a bulge in differences between scores of groups

TABLE XI

PERFORMANCE OF PUPILS ON SPATIAL PREPOSITIONS

TEST SECTIONS BY NON-LANGUAGE I.Q.

Subjects	Mean Non-Language I.Q.	PUPIL PERFORMANCE ON TEST SECTIONS: V(ORAL) — NON-VERBAL Mean Scores 40/40	V(ORAL) — NON-VERBAL Difference of Means	V(ORAL) — V(ORAL) Mean Scores 40/40	V(ORAL) — V(ORAL) Difference of Means	READING — NON-VERBAL Mean Scores 40/40	READING — NON-VERBAL Difference of Means
K High I.Q.-N.L.	125.45	26.20		18.10			
Low I.Q.-N.L.	97.00	24.80	1.40	17.05	1.05		
1 High I.Q.-N.L.	118	32.35		20.85		27.40	
Low I.Q.-N.L.	96.35	29.60	2.75	16.85	4.00	24.65	2.75
2 High I.Q.-N.L.	107.50	32.15		24.30		31.80	
Low I.Q.-N.L.	95.85	30.90	1.25	21.70	2.60	28.45	3.35

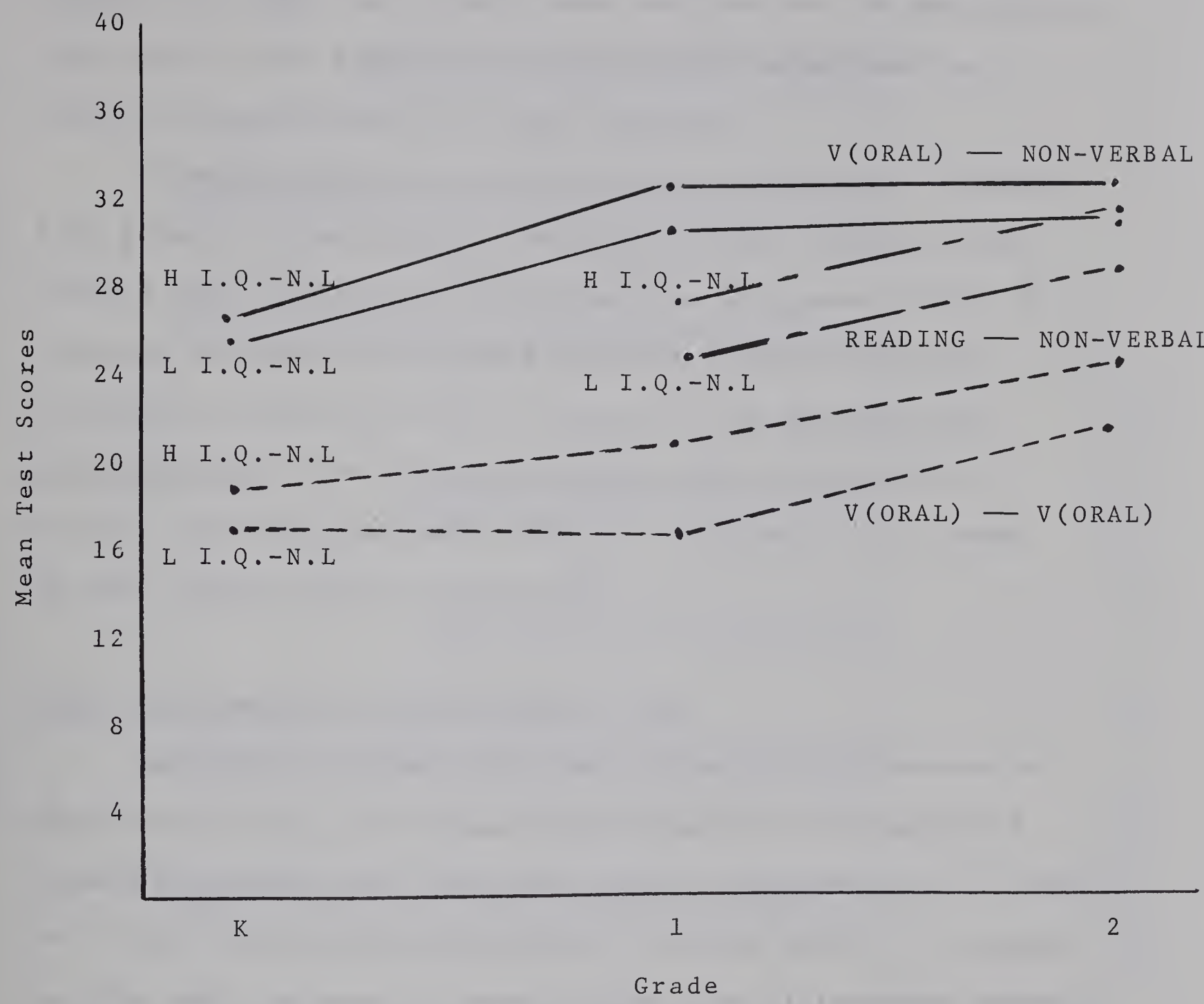


FIGURE VII

PUPIL PERFORMANCE ON SPATIAL PREPOSITIONS TEST

BY NON-LANGUAGE I.Q. ACROSS THE GRADES

appears in grade one in both test sections but it was greater when pupils were required to demonstrate understanding of spatial prepositions by an oral response.

Plotting the mean scores of language and non-language I.Q. groups for each grade and mode section (Figure VIII) reveals that while the differences are not great, there is a tendency in favor of language I.Q. to produce a greater difference between groups in scores on the Spatial Prepositions Test. As noted previously, the trend toward a greater difference between scores of language I.Q. groups is most readily seen in grade one.

Pupil Performance by Chronological Age

Table XII presents the mean scores and difference of means obtained by the group in the sample on two modes of stimulus-response test sections giving consideration to higher and lower chronological age groups in each grade. In comparing the performances of these groups, the differences between mean scores in each grade clearly show that in both modes of stimulus-response sections scores of the older children in grade two became considerably more diversified than those of the children in kindergarten and grade one. Children from both age groups in kindergarten and grade one were essentially equally competent in these test aspects, but younger children in grade one scored as well as or better than the younger pupils in grade two in the Verbal (Oral) — Non-Verbal stimulus-

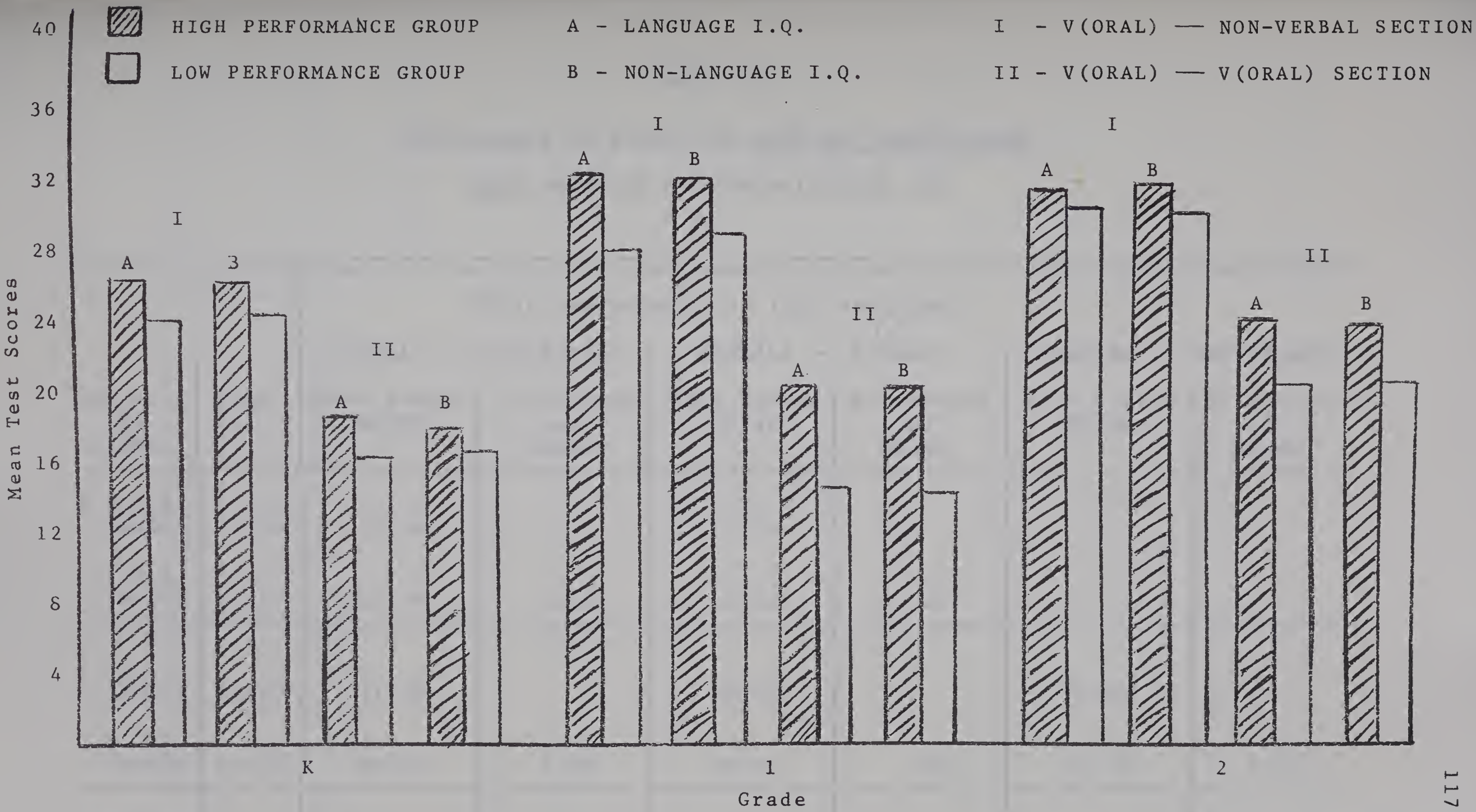


FIGURE VIII

PUPIL PERFORMANCE ON TWO SECTIONS OF SPATIAL PREPOSITIONS TEST BY LANGUAGE AND NON-LANGUAGE I.Q. ACROSS THE GRADES

TABLE XII

PERFORMANCE OF PUPILS ON SPATIAL PREPOSITIONS

TEST SECTIONS BY CHRONOLOGICAL AGE

		PUPIL PERFORMANCE ON TEST SECTIONS:					
		V(ORAL) — NON-VERBAL		V(ORAL) — V(ORAL)		READING — NON-VERBAL	
Subjects by Grade	Mean C.A.	Mean Scores 40/40	Difference of Means	Mean Scores 40/40	Difference of Means	Mean Scores 40/40	Difference of Means
K H C.A. (N=20)	72.30	26.30		17.30			
L C.A. (N=20)	66.45	24.70	1.60	17.85	.55		
1 H C.A. (N=20)	84.65	31.60		18.55		26.65	
L C.A. (N=20)	78.70	30.35	1.25	19.15	.60	25.40	1.25
2 H C.A. (N=20)	98.10	33.15		25.35		30.80	
L C.A. (N=20)	92.55	29.90	3.25	20.65	4.70	92.45	1.35

response. By grade two, it would appear that chronological age is influential in scores obtained by older children with less difference in scores obtained between older and younger children in the Verbal (Oral) — Non-Verbal portion of the test. Across the grades the older children in grade two seem to have developed both a better concept of spatial position and more ability in attaching accurate verbal labels to this concept. These results are illustrated graphically in Figure IX.

McLeod's research (1969) with kindergarten children indicated a slight shift with age in favor of the younger children in ability to use and understand prepositions of spatial position. Welch and Long (1940), whose experiments dealt mostly with preschool children, believe that chronological age may have more influence on concept formation than does mental age. The reverse situation was found to exist with the preschool children in the present study. Intelligence was revealed as a more significant predictor of accurate responses.

Section Summary

Analysis of test scores on the Spatial Prepositions Test revealed a gradual and definite progression from kindergarten to grade two in ability to demonstrate understanding of prepositions of spatial position in each of the two modes of stimulus-response test sections investigated. Scores in each

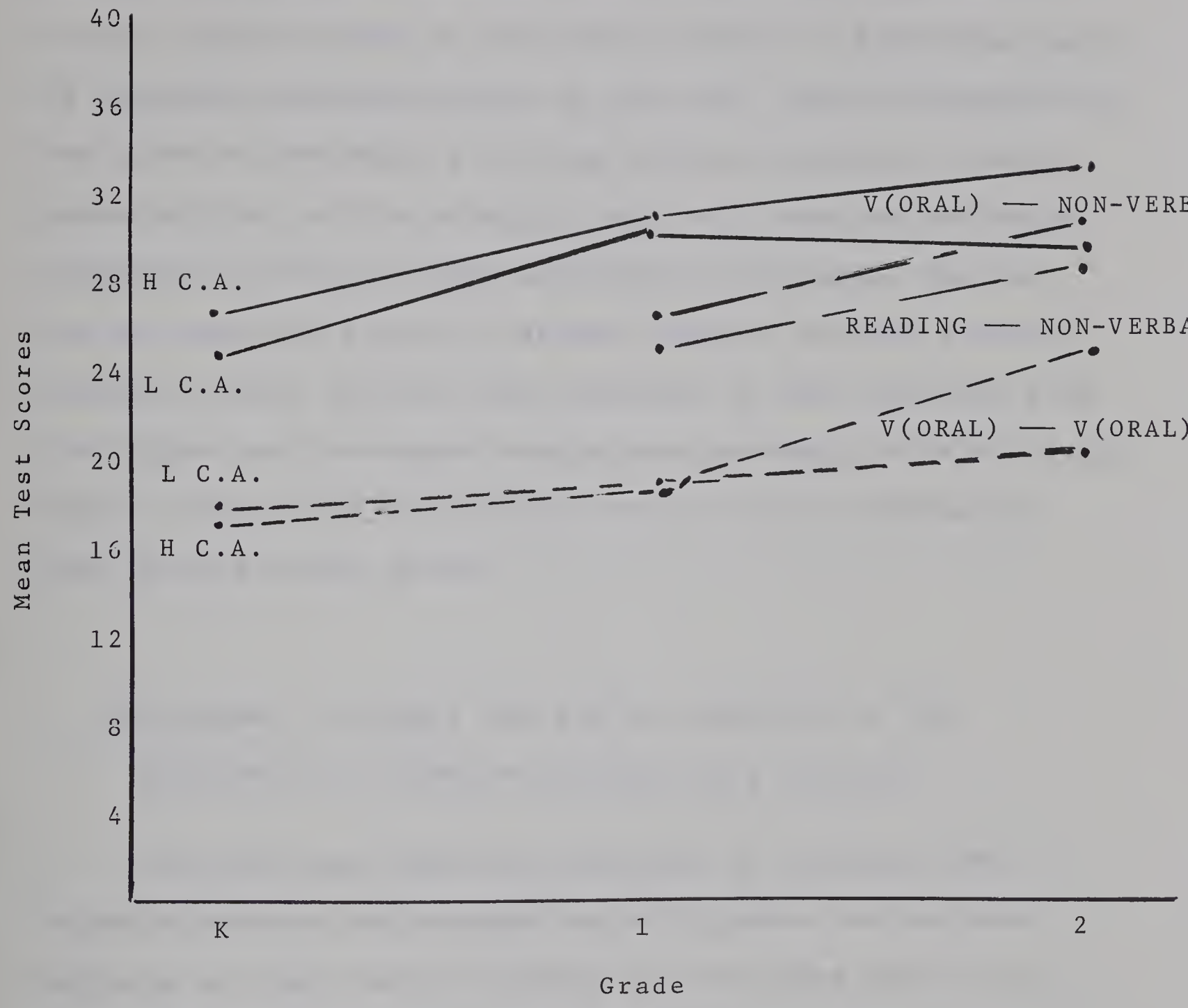


FIGURE IX

PUPIL PERFORMANCE ON SPATIAL PREPOSITIONS TEST

BY CHRONOLOGICAL AGE ACROSS THE GRADES

grade were found to increase from the Verbal (Oral) — Verbal (Oral) section to the Verbal (Oral) — Non-Verbal mode of stimulus-response portion of the test. When consideration was given to variables affecting subjects' scores, intelligence factors and chronological age were found to influence children's scores on these portions of the test. Sex was not an important factor in scores achieved and while socio-economic status exerted some influence in that children from the higher socio-economic status were generally able to obtain higher scores, the differences between scores obtained by each group were not great.

PERFORMANCE OF GRADES ONE AND TWO SUBJECTS ON THE THIRD MODE OF STIMULUS-RESPONSE TEST SECTION

An additional three-way analysis of variance with repeated measure was carried out with grades one and two subjects so that scores obtained for the third mode of stimulus-response section, the Reading — Non-Verbal, might be compared with the other two test sections. The effect of grade, sex, socio-economic status, intelligence, chronological age and reading achievement as measured by test scores on this mode of stimulus-response section was also included in this analysis.

Results of the Spatial Prepositions Test as indicated by mean scores and difference of means of the Reading —

Non-Verbal stimulus-response test section are given in Table V. In comparing the mean scores it may be seen that grade two were able to score higher on the Reading — Non-Verbal mode of stimulus-response section which suggests that the additional year of reading and experience may have helped these pupils in developing a better understanding of the concept of spatial position when reading. Subjects in both grades one and two scored lower on the reading section of the test than on the other non-verbal section, the Verbal (Oral) — Non-Verbal stimulus-response, but the difference between mean scores in these sections for pupils in grade two was minimal.

Pupil Performance by Sex

As shown on Table VII, a differential effect between boys and girls is present in grade two in that girls exhibit a higher level of performance on the Reading — Non-Verbal test aspects, but the differences are not great. Boys and girls in grade one performed about equally well on this section of the Spatial Prepositions Test.

Pupil Performance by SES

Inspection of mean scores when the reading stimulus-response section of the test was included (Table VIII) shows that socio-economic status was not an important variable in affecting scores achieved for grades one and two pupils. A

difference of means of 1.35 for grade one and only .75 for grade two are shown, variations which may be due to sampling differences. In grade two in this section as in the other sections of the test, differences between higher and lower SES subjects were minimal. Thus SES is not suggested as a factor influencing the understanding of the concept of spatial position when reading.

Pupil Performance by Total I.Q.

Intelligence was found to influence success on test items when the responses of grades one and two subjects were analyzed for the Reading — Non-Verbal test section. The mean scores given in Table IX are an indication that upper I.Q. subjects in each grade demonstrated more competence in this mode portion than the lower I.Q. group, with a greater difference between groups indicated in grade one.

In the graphic illustration, Figure V, it can be seen that grade two subjects with lower intelligence quotient scores, were more competent in demonstrating correct spatial position when a reading stimulus was provided than grade one subjects with higher intelligence quotients. Thus, for grade one pupils, other factors than intelligence alone would appear to be operant in the understanding of concepts when reading.

As when two modes were examined, dichotomized language and non-language I.Q. groups were formed in order to delineate

wherein the significance of the intelligence factor lay. Consideration in the analysis was given to each variable separately.

Pupil Performance by Language I.Q.

Table X shows the resultant scores when language I.Q. was examined in the light of the two groups for each of grades one and two in the Reading — Non-Verbal section of the test. The mean scores indicate that higher language I.Q. groups obtained the better scores in each grade but the difference between scores of groups in grade one was considerably greater than in grade two. As Figure VI illustrates, a distinct difference for the Reading — Non-Verbal stimulus-response is indicated between groups in grade one which would suggest that at this level, ability to comprehend the concept of spatial position presented in printed form is considerably less difficult for pupils with a higher language intelligence quotient.

Pupil Performance by Non-Language I.Q.

Mean scores giving consideration to non-language I.Q. are summarized in Table XI. These scores reveal, that among subjects in both grades one and two, children with high non-language intelligence quotients were better able to demonstrate understanding of prepositions of spatial position in this portion of the test than were children with low non-

language intelligence. Contrary to when the language aspects of intelligence were considered, a greater difference is shown between non-language I.Q. groups in grade two than in grade one, even though the difference between mean non-language intelligence quotients is considerably less for grade two. It is interesting that across mode test sections, differences between groups for grade two is greatest in the Reading — Non-Verbal portion of the test.

The mean scores of language and non-language I.Q. groups in grades one and two have been plotted in Figure X so that comparison might be made of the performances of these groups on the third section of the Spatial Prepositions Test as compared to performance on the other two test sections. Generally speaking, high language I.Q. groups in grade one performed better on the Reading — Non-Verbal test aspects but high language and non-language I.Q. groups in grade two performed about equally well in this portion of the test.

Pupil Performance by Reading Achievement

Reading achievement as tested by the Gates-MacGinitie Reading Tests was also considered as a variable affecting subjects' responses on test sections in grades one and two. As previously with sex, age, socio-economic status and intelligence factors, reading achievement was examined in the light of the two reading achievement groups considered in the sample. Table XIII provides a breakdown of mean scores

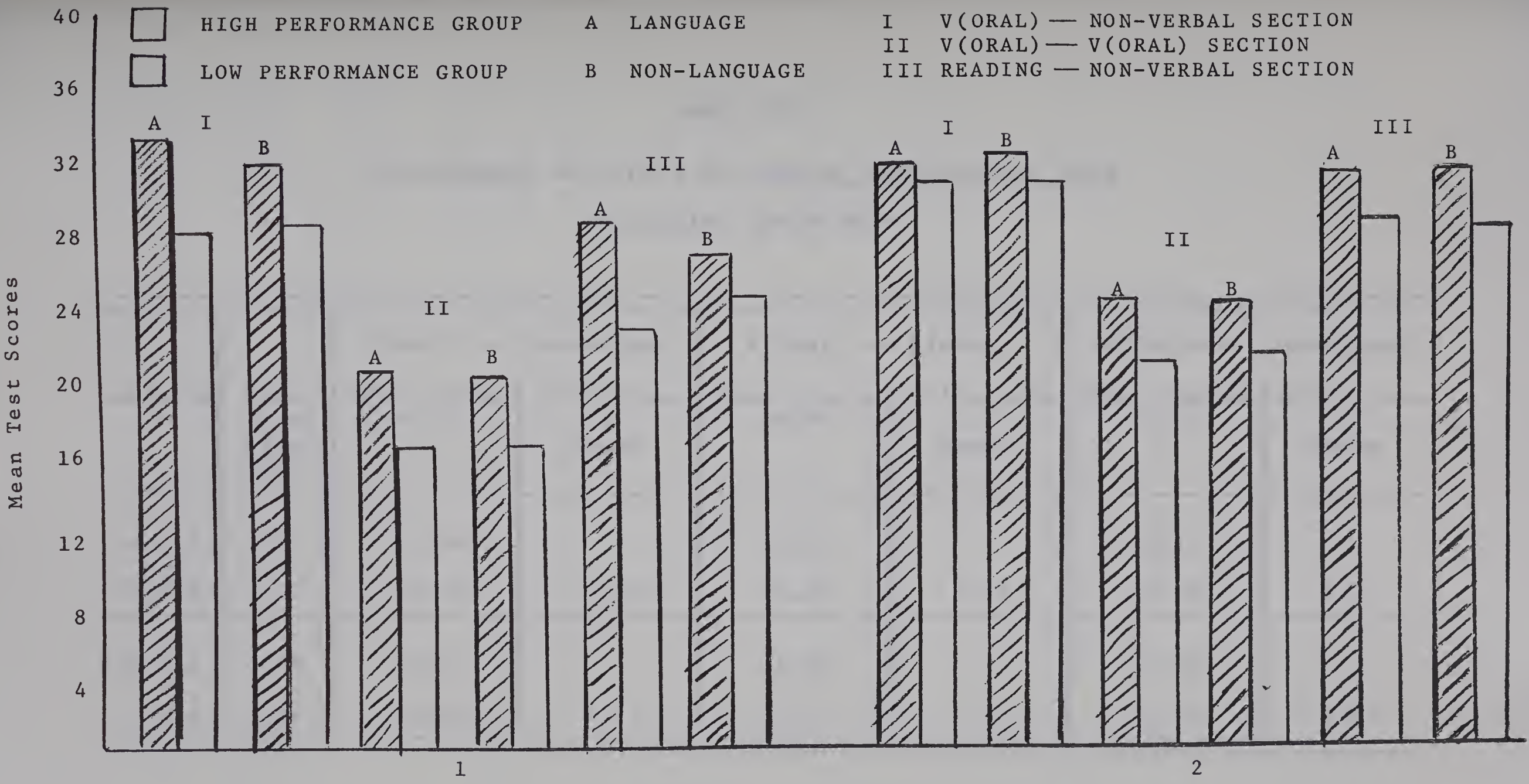


FIGURE X

PUPIL PERFORMANCE ON THREE SECTIONS OF SPATIAL PREPOSITIONS TEST BY LANGUAGE AND NON-LANGUAGE I.Q.



TABLE XIII

PERFORMANCE OF PUPILS ON SPATIAL PREPOSITIONS TEST

BY READING ACHIEVEMENT

Subjects	Mean Grade Rdng. Ach.	V(ORAL) — NON-VERBAL		V(ORAL) — V(ORAL)		READING — NON-VERBAL	
		Mean Scores 40/40	Difference of Means	Mean Scores 40/40	Difference of Means	Mean Scores 40/40	Difference of Means
1 H R.A.	2.83	32.40		21.65		28.15	
L R.A.	1.43	29.55	2.85	16.05	5.60	23.90	4.25
2 H R.A.	3.66	32.95		24.85		32.15	
1 R.A.	1.98	30.10	2.85	21.15	3.70	28.90	3.25

and difference of means by reading achievement for each mode section. The data indicates that the scores of high reading achievement groups were above those of low reading achievement groups in each mode section examined. In the Reading — Non-Verbal stimulus-response section, the difference between performance of high and low reading achievement groups was greater in grade one, but this difference was small.

Across grades one and two as illustrated in Figure XI, there was an increase in the scores of grade two pupils over grade one in all responses except in the Verbal (Oral) — Non-Verbal test items where mean scores and differences of means between groups were almost identical. The greatest difference between scores obtained by high and low reading achievers, 5.60, is found in grade one in the Verbal (Oral) — Verbal (Oral) test section. Thus, in grade one, ability to recognize spatial position and use accurate terms in describing it, and to demonstrate understanding of the concept when reading, is indicated as a less difficult task for the better readers.

Pupil Performance by Chronological Age

Chronological age was found to have little effect on responses on test items for grades one and two when the third mode of stimulus-response section was investigated. Upon examining the data of the age groups within these grades (Table XII), it becomes obvious that there was little differ-

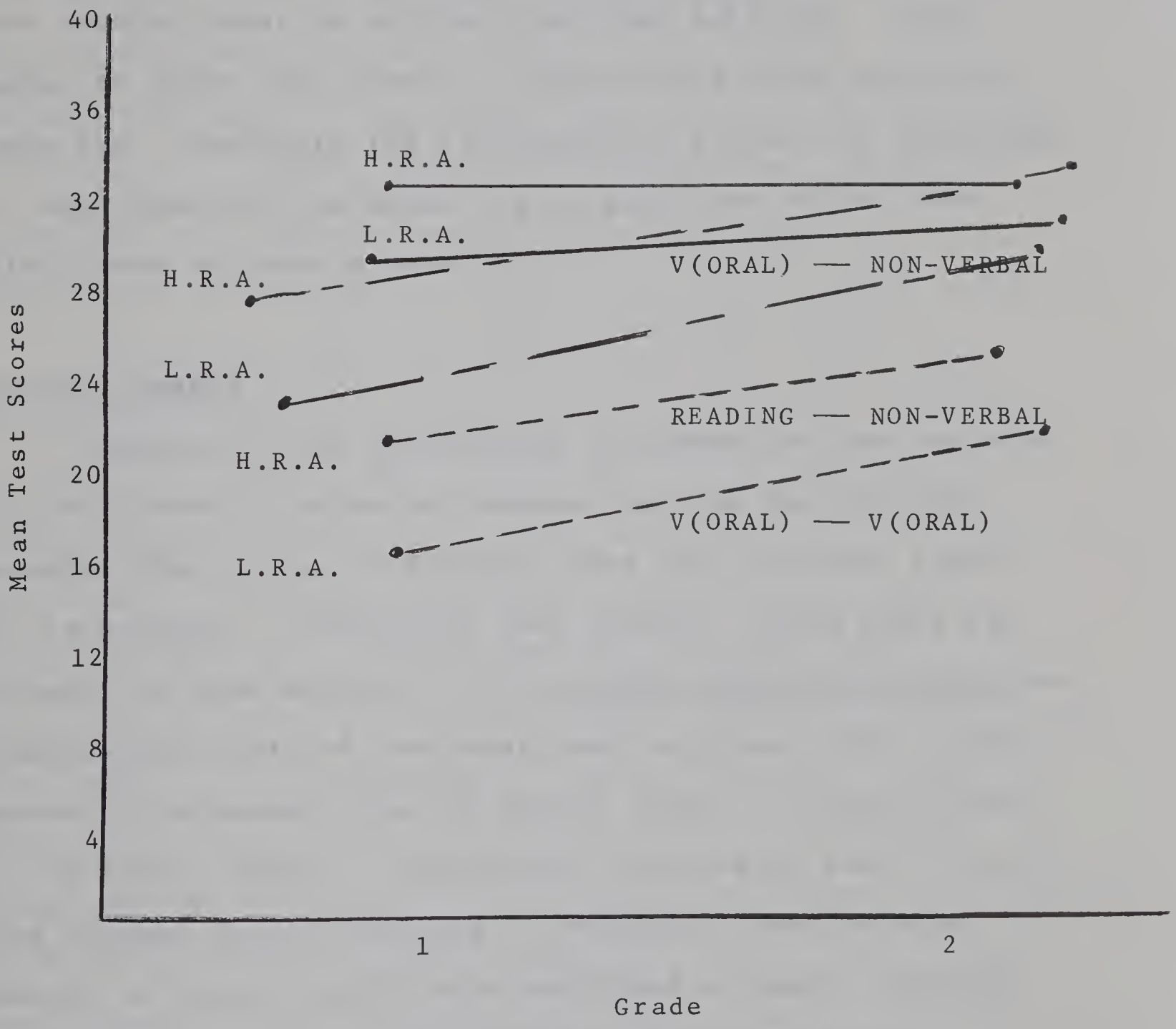
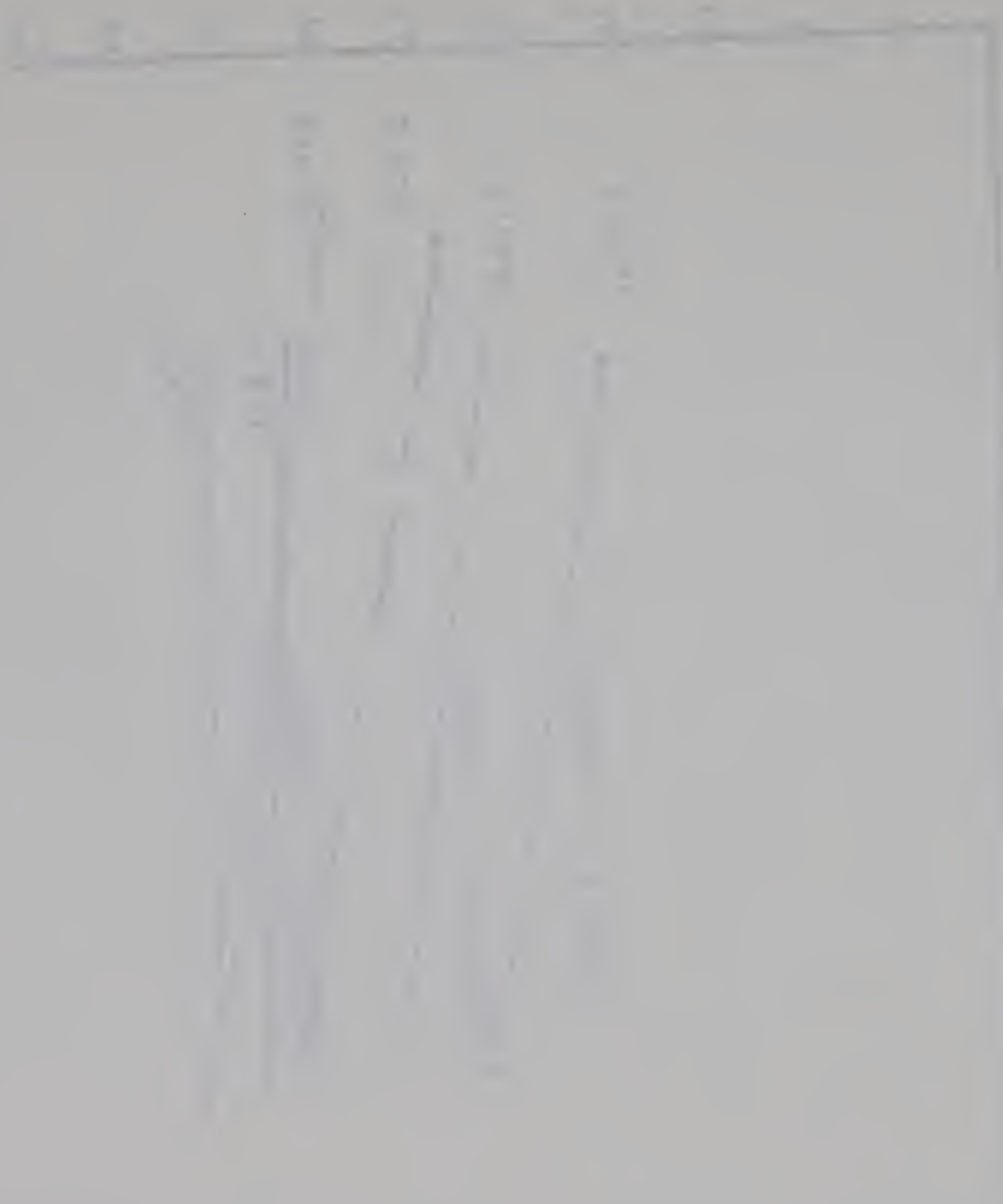


FIGURE XI

PUPIL PERFORMANCE ON SPATIAL PREPOSITIONS TEST

BY READING ACHIEVEMENT



ence between performance of chronological age groups in this test section. Younger subjects in each grade understood the concept of spatial position as represented by prepositions when reading about as well as the older subjects. Older pupils in grade two, however, scored above older pupils in grade one. Therefore the difference in scores for chronological age appeared from grade one to grade two rather than within each of these grades.

Section Summary

Analysis of the performance of grades one and two when the third mode of stimulus-response section was included revealed that grade two subjects were able to score higher on the Reading — Non-Verbal test aspects. When pupil performance on this section of the Spatial Prepositions Test was compared with that of the other test sections, mean scores generally increased from the Verbal (Oral) — Verbal (Oral) to the Verbal (Oral) — Non-Verbal portions of the test and then dropped for the Reading — Non-Verbal test section. Results of grade one subjects exhibited a greater increase in difference of means than those of grade two pupils.

Intelligence, reading achievement and chronological age were found to be influential in scores achieved on the Reading — Non-Verbal stimulus-response section. Sex and socio-economic status did not appear to affect children's test scores.

CORRELATIONAL ANALYSES

To show the relationship between responses made on each of the tasks in the Spatial Prepositions Test and the variables of socio-economic status, intelligence, chronological age, and reading achievement, correlations were established by using the computer program DEST Ø2. These coefficients are shown in Table XIV for the total sample as well as for the three grade levels considered in this study.

A study of Table XIV reveals that when considering the correlation between socio-economic status and the understanding of prepositions of spatial position as indicated by scores obtained on each test task, no significant correlation was found. At no one grade level did the higher socio-economic status subjects perform significantly better than the lower socio-economic status pupils. Negative correlations were found in every grade and in the total sample, with the exception of grade one where low positive correlations appeared. This would indicate that socio-economic status alone is not a significant positive predictor of ability to understand prepositions of spatial position as measured in this study.

When intelligence was correlated with ability to understand prepositions of spatial position, significant correlations were found to exist in all grades and in the total sample. On the basis of the accepted .05 level of significance, the positive correlation of .25 with scores on the

TABLE XIV

CORRELATION OF VARIABLES OF SOCIO-ECONOMIC STATUS, INTELLIGENCE, CHRONOLOGICAL AGE AND READING ACHIEVEMENT WITH UNDERSTANDING OF SPATIAL PREPOSITIONS

Subjects by Grade	SOCIO-ECONOMIC STATUS WITH: Modes				INTELLIGENCE WITH: Modes			
	V(O)-N.V.	V(O)-V(O)	Rdng.-N.V.	Total	V(O)-N.V.	V(O)-V(O)	Rdng.-N.V.	Total
K (N=40)	.18	-.01		.09	.25	.39**		.37*
1 (N=40)	.23	.16	.01	.19	.46***	.56***	.44***	.56**
2 (N=40)	-.07	-.26	-.09	-.19	.42**	.57***	.59***	.63***
Total Sample (N=120)	.11	-.04		-.07	.17	.29***		-.10

For a two-tailed test of significance:
* Significant at the .05 level.
** Significant at the .01 level.
*** Significant at the .001 level.

TABLE XIV (CONTINUED)

Subjects by Grade	CHRONOLOGICAL AGE WITH: Modes V(O)-N.V.	V(O)-V(O)	Rdng.-N.V.	Total	READING ACHIEVEMENT WITH: Modes V(O)-N.V.	V(O)-V(O)	Rdng.-N.V.	Total
K (N=40)	.09	-.09		-.00				
1 (N=40)	.08	.01	.14	.09	.46***	.56***	.47***	.58***
2 (N=40)	.42***	.49***	.21	.47***	.38*	.45***	.39**	.52***
Total Sample (N=120)	.49***	.42***		.64***				

Verbal (Oral) — Non-Verbal subtest in kindergarten failed to reach the level of significance, but when scores on the Verbal (Oral) — Verbal (Oral) section and total scores were considered, the positive correlations of .39 and .37 respectively, were significant at the .01 and .02 levels. It is noted that in grades one and two, correlations shown for each mode of stimulus-response section and for total scores were positive and highly significant (.001). In the total test sample, intelligence was significantly correlated with understanding of prepositions of spatial position in the Verbal (Oral) — Verbal (Oral) test section but not when total scores for two modes of stimulus-response sections were analyzed. Thus a closer relationship between the understanding of spatial position and intelligence is indicated in grades one and two than in kindergarten. For all grades a higher positive correlation was obtained for the Verbal (Oral) — Verbal (Oral) mode of stimulus-response test section than for the other sections.

Chronological age was not significantly related to the understanding of the concept of spatial position in kindergarten and grade one when individual grades were given consideration. However, the findings indicate that in grade two, the correlations obtained between scores on the Verbal (Oral) — Non-Verbal and Verbal (Oral) — Verbal (Oral) subtests were significant at the .001 level. It is also seen that the low positive correlation, .21 with scores achieved

on the Reading — Non-Verbal stimulus-response section in grade two failed to reach significance, even though correlations with scores attained on the other two test sections were highly significant. A similar situation exists in grade one where the low positive correlation of .14 with scores on the Reading — Non-Verbal section were not significant. Thus, ability to understand the concept of spatial position when reading was not indicated as being closely associated with the chronological age of these subjects. Table XIV shows that when the total test sample was investigated, highly significant positive correlations at the .001 level were present between the chronological age of the subjects and their scores on the two mode sections examined. Thus, correlations obtained indicate that as children become older, they are better able to understand prepositions which denote spatial position.

The correlations between the reading achievement of the subjects in grades one and two and their scores on the three test sections, and total scores, are also presented in Table XIV. It will be noticed that all correlations were positive and significant. Coefficients obtained for grade two are lower than those indicated for grade one subjects. It may be assumed therefore that the child's ability to understand prepositions of spatial position as measured in this study is closely linked to his ability to read. That is, if the child is having difficulty in reading words and sentences, he

will also experience more difficulty in understanding the concepts represented by the printed words. Reading ability is indicated as a better predictor of performance on the Spatial Prepositions Test for grade one subjects than for pupils in grade two.

Section Summary

The major findings of the correlational analyses are as follows:

(1) No statistically significant relationship exists between socio-economic status and the ability to understand prepositions of spatial position.

(2) A positive and highly significant statistical relationship exists between intelligence and demonstration of ability to understand prepositions of spatial position in grades one and two. In kindergarten, a close relationship is found between intelligence and scores on the Verbal (Oral) — Verbal (Oral) stimulus-response section and between intelligence and total scores on the Spatial Prepositions Test. Intelligence is significantly positively correlated with scores on the Verbal (Oral) — Verbal (Oral) mode section only when the total test sample is considered.

(3) A positive statistically significant relationship exists between chronological age and the ability to understand prepositions of spatial position when scores for the

total test sample are considered and in grade two for all test scores except those obtained on the Reading — Non-Verbal mode of stimulus-response.

(4) A statistically significant relationship exists between reading achievement ability and the ability to understand prepositions denoting spatial position in grades one and two. A higher positive correlation exists between scores on the Verbal (Oral) — Non-Verbal and Reading — Non-Verbal sections for subjects in grade one than for pupils in grade two.

ANALYSES OF VARIANCE

Various statistical analyses of variance were attempted in the present study to avoid two similar analyses but these were unsuccessful. The similarity of the following analyses is acknowledged.

Analyses of Variance on Two Modes of Stimulus-Response Sections

Sex. Table XV presents a summary of the findings of the analysis when sex, grade and mode of stimulus-response section were considered. Significant main effects of grade and stimulus-response section were evident, indicating that there were significant differences in scores among the grades and between modes of stimulus-response sections. Sex, however, was not a significant factor in affecting scores achieved

TABLE XV

SUMMARY OF ANALYSIS OF VARIANCE BY GRADE, SEX AND TWO MODES OF STIMULUS-RESPONSE TEST SECTIONS

SOURCE OF VARIATION	SS	DF	MS	F	P
Between Subjects	5109.31	119			
Grade	1325.00	2	662.50	20.04	0.00*
Sex	14.44	1	14.44	.44	0.51
Grade x Sex	1.75	2	.87	.03	.97
Subjects within Group	3768.12	114	33.05		
Within Subjects	7135.50	120			
Mode of Stimulus-Response	5443.50	1	5443.50	429.34	0.0*
Grade x Mode	206.44	2	103.22	8.14	0.00*
Sex x Mode	33.12	1	33.12	2.61	0.11
Grade x Sex x Mode	7.06	2	3.53	.28	.76
Mode x Subjects within Group	1445.37	114	12.68		

* Significant at .001.

on the two modes of stimulus-response test sections examined. As seen on Table XIV, there was no three-way interaction among the variables considered, but a two-way interaction between grade and mode of stimulus-response section significant at the .001 level, was evident. That is, grade level of pupil and the mode of stimulus-response section together had a differential effect on the understanding of prepositions of spatial position by boys and girls even though there was no main effect of the sex variable.

SES. There were differences between scores of higher and lower SES subjects but these differences were not statistically significant at the level accepted in this study. Again, there was a main effect of grade and mode by themselves and these variables were interacting to significantly vary responses provided by subjects in each SES strata. These findings are given in Table XVI.

Intelligence. Table XVII indicates that when intelligence was considered the probability of children of high intelligence achieving the higher scores by chance was less than one in a thousand. The variables of intelligence, grade and mode section each had a significant main effect on pupil performance but there was no interaction among these three variables. Further examination of the data to discover if there were any interactions between any two of the variables found only one significant interaction, that between grade and mode of stimulus-response section. In the

TABLE XVI

SUMMARY OF ANALYSIS OF VARIANCE BY GRADE, SES AND TWO MODES OF STIMULUS-RESPONSE TEST SECTIONS

SOURCE OF VARIATION	SS	DF	MS	F	P
Between Subjects	5109.31	119			
Grade	1325.00	2	662.50	21	0.00*
SES	87.50	1	87.50	2.77	0.099
Grade x SES	101.19	2	50.59	1.60	0.21
Subjects within Group	3595.62	114	31.44		
Within Subjects	7135.50	120			
Mode of Stimulus-Response	5443.50	1	5443.50	420.33	0.0*
Grade x Mode	206.44	2	103.22	7.97	0.00*
SES x Mode Section	7.12	1	7.12	0.55	0.46
Grade x SES x Mode Section	2.06	2	1.03	0.08	0.92
Mode x Subjects within Group	1476.37	114	12.95		

* Significant at .001.

TABLE XVII

SUMMARY OF ANALYSIS OF VARIANCE BY GRADE, TOTAL I.Q. AND TWO MODES OF STIMULUS-RESPONSE TEST SECTIONS

SOURCE OF VARIATION	SS	DF	MS	F	P
Between Subjects	5109.31	119			
Grade	1325.00	2	662.50	25.98	0.00*
Total I.Q.	839.94	1	839.94	32.94	0.00*
Grade x I.Q.	37.31	2	18.66	0.73	0.48
Subjects within Group	2907.06	114	25.50		
Within Subjects	7135.50	120			
Mode of Stimulus-Response	5443.50	1	5443.50	425.57	0.0*
Grade x Mode	206.44	2	103.22	8.07	0.001*
I.Q. x Mode	27.44	1	27.44	2.15	0.15
Grade x I.Q. x Mode	6.25	2	3.12	-0.00	1.0
Mode x Subjects within Group	1458.19	114	12.79		

* Significant at .001.

light of this interaction finding the highly significant main effect of intelligence must be qualified. Performance for the I.Q. groups considered in the study was not uniform.

Language I.Q. The findings as presented in Table XVIII revealed significant differences at the .001 level in children's scores of higher and lower language I.Q. groups. As before, grade and section mode of test each had a significant main effect on scores achieved. No three-way interaction among the variables was evident but significant interaction between grade and mode of stimulus-response section was present. Therefore in addition to the main effect of the language I.Q. factor, the grade of the pupils and the mode of stimulus-response section had differential effects on children's scores.

Non-Language I.Q. Table XIX shows a significant difference, at the .003 level between performance of high and low non-language i.Q. groups. Grade and mode of stimulus-response section were again highly significant in affecting correct responses on the Spatial Prepositions Test separately and by interaction. Therefore, the .003 level of main effect significance for non-language I.Q. must be modified giving consideration to the inclusion of the effect of these variables.

Chronological Age. A main effect of .03 significance level was shown (Table XX) when chronological age was examined. The performance of the older subjects in the study

TABLE XVIII

SUMMARY OF ANALYSIS OF VARIANCE BY GRADE, LANGUAGE I.Q. AND TWO MODES OF STIMULUS-RESPONSE TEST SECTIONS

SOURCE OF VARIATION	SS	DF	MS	F	P
Between Subjects	5109.31	119			
Grade	1325.00	2	622.50	24.54	0.00
Language I.Q.	623.94	1	623.94	23.11	0.00*
Grade x Language I.Q.	83.00	2	41.50	1.54	0.22
Subjects within Group	3077.37	114	26.99		
Within Subjects	7135.50	120			
Mode of Stimulus-Response	5443.50	1	5443.50	430.64	0.0*
Grade x Mode	206.44	2	103.22	8.17	0.00*
Language I.Q. x Mode	1.62	1	1.62	0.13	0.72
Grade x Language I.Q. x Mode	42.94	2	21.47	1.70	0.19
Mode x Subjects within Group	1441.00	114	12.64		

* Significant at .001.

TABLE XIX

SUMMARY OF ANALYSIS OF VARIANCE BY GRADE, NON-LANGUAGE I.Q. AND TWO MODES OF STIMULUS-RESPONSE TEST SECTIONS

SOURCE OF VARIATION	SS	DF	MS	F	P
Between Subjects	5109.31	119			
Grade	1325.00	2	662.50	21.88	0.00**
Non-Language I.Q.	283.81	1	283.81	9.37	0.003*
Grade x Non-Language I.Q.	48.12	2	24.06	0.79	0.45
Subjects within Group	3452.37	114	30.28		
Within Subjects	7135.50	120			
Mode of Stimulus-Response	5443.50	1	5443.50	422.72	0.0**
Grade x Mode	206.44	2	103.22	8.02	0.001*
Non-Language I.Q. x Mode	8.50	1	8.50	0.66	0.42
Grade x Non- Language I.Q. x Mode	9.06	2	4.53	0.35	0.70
Mode x Subjects within Group	1468.00	114	12.88		

* Significant at .003.
** Significant at .001.

TABLE XX

SUMMARY OF ANALYSIS OF VARIANCE BY GRADE, CHRONOLOGICAL AGE AND TWO MODES OF STIMULUS-RESPONSE TEST SECTIONS

SOURCE OF VARIATION	SS	DF	MS	F	P
Between Subjects	5109.31	119			
Grade	1325.00	2	662.50	21.82	0.00**
Chronological Age	155.12	1	115.12	5.11	0.02*
Grade x Chronological Age	168.56	2	84.28	2.78	0.07
Subjects within Group	3460.62	114	30.36		
Within Subjects	7135.50	120			
Mode of Stimulus-Response	5443.50	1	5443.50	432.48	0.0**
Grade x Mode	206.44	2	103.22	8.20	0.00**
Chronological Age x Mode	10.94	1	10.94	0.87	0.35
Grade x Chronological Age x Mode	39.75	2	19.87	1.58	0.21
Mode x Subjects within Group	1434.87	114	12.59		

* Significant at .05 level.
** Significant at .001 level.

was significantly higher than that of the younger subjects. As in previous analyses, grade and mode test section each had a statistically significant main effect on scores achieved. There was no three-way interaction among the variables considered but two-way interactions were evident between grade and chronological age and between grade and mode section. Although the level of significance (.07) recorded for the interaction between grade and chronological age was not statistically significant, the combined interaction effect of grade and mode test section was highly significant (.001) in affecting scores achieved.

Analyses of Variance Including the Third Mode of Stimulus-Response Section

Sex. Table XXI presents a summary of the analysis of variance considering grade, sex and mode of stimulus-response section when the third test section of the Spatial Prepositions Test was included. As when two mode sections were analyzed, no differences were found between scores of boys and girls in grades one and two. Thus there was no apparent difference in performance of boys and girls in the Reading — Non-Verbal section of the test. Grade and mode of stimulus-response section each had a significant main effect on scores of boys and girls, however, and an interaction between these variables was found. There was no evidence

TABLE XXI

SUMMARY OF ANALYSIS OF VARIANCE BY GRADE, SEX AND THREE MODES OF STIMULUS-RESPONSE TEST SECTIONS

SOURCE OF VARIATION	SS	DF	MS	F	P
Between Subjects	4309.62	79			
Grade	516.19	1	516.19	10.34	0.002*
Sex	-0.12	1	-0.12	-0.00	1.0
Grade x Sex	0.31	1	0.31	0.01	0.94
Subjects within Group	3793.25	76	49.91		
Within Subjects	6453.37	160			
Mode of Stimulus-Response	4474.87	2	2237.44	196.50	0.0**
Grade x Mode	170.50	2	85.25	7.49	0.00*
Sex x Mode	68.25	2	34.12	3.00	0.053
Grade x Sex x Mode	9.00	2	4.50	0.40	0.67
Mode x Subjects within Group	1730.75	152	11.38		

* Significant at .002.
** Significant at .001.

of three-way interaction among the variables considered. Therefore, grade and mode of test section separately and together were producing a differential effect between scores of boys and girls by grade and section even though no main effect of sex was found.

SES. As seen in the statistical analysis presented in Table XXII, no main effect in scores of higher and lower SES groups was indicated but the main effect of grade and mode section of test were significant when the third mode section was included. In addition, two-way interaction between these variables had a differential effect on scores achieved by SES groups among the grades and mode test sections. There was no three-way interaction among the variables considered.

Total I.Q. When performance of higher and lower I.Q. groups was considered in this analysis the results were similar to those obtained when the first two test sections were examined. Scores were significantly higher for children with higher intelligence quotients, but once again grade level of pupil and test section each had a main effect on these scores. No interaction was evident among the three variables but two-way interaction between grade and mode of stimulus-response section was again apparent. The highly significant main effect of total I.Q., therefore, is qualified to give recognition to the additional main effects and the combination effect of interaction. Table XXIII gives a summary of this analysis.

TABLE XXII

SUMMARY OF ANALYSIS OF VARIANCE BY GRADE, SES AND THREE MODES OF STIMULUS-RESPONSE TEST SECTIONS

SOURCE OF VARIATION	SS	DF	MS	F	P
Between Subjects	4309.62	79			
Grade	516.19	1	516.19	10.75	0.002*
SES	32.19	1	32.19	0.67	0.42
Grade x SES	112.19	1	112.19	2.34	0.13
Subjects within Group	3649.06	76	48.01		
Within Subjects	6453.38	160			
Mode of Stimulus-Response	4474.87	2	2237.44	189.39	0.0**
Grade x Mode	170.50	2	85.25	7.22	0.001**
SES x Mode	8.19	2	4.09	0.35	0.71
Grade x SES x Mode	4.12	2	2.06	0.17	0.84
Mode x Subjects Within Group	1795.69	152	11.81		

* Significant at .002.
** Significant at .001.

TABLE XXIII

SUMMARY OF ANALYSIS OF VARIANCE BY GRADE, TOTAL I.Q. AND THREE MODES OF STIMULUS-RESPONSE TEST SECTION

SOURCE OF VARIATION	SS	DF	MS	F	P
Between Subjects	4309.62	79			
Grade	516.19	1	516.19	14.27	0.000*
I.Q.	1016.69	1	1016.69	28.11	0.000*
Grade x I.Q.	28.19	1	28.19	0.78	0.38
Subjects within Group	6453.37	160			
Mode of Stimulus-Response	4474.87	2	2237.44	190.02	0.0*
Grade x Mode	170.50	2	85.25	7.24	0.00*
I.Q. x Mode	18.37	2	9.19	0.78	0.46
Grade x I.Q. x Mode	-0.12	2	6.25	-0.01	1.0
Mode x Subjects within Group	1789.75	152	11.77		

* Significant at .001.

Language I.Q. Table XXIV reports the highly significant difference between pupils' scores of higher and lower language I.Q. groups. Main effects of grade and mode of stimulus-response section were again evident. The one difference not found when two sections were analyzed previously is the evidence of some interaction although not significant between grade and language I.Q. No interaction among the three variables considered was revealed. As before, the effect of the two-way interaction between grade and mode of stimulus-response section and the main effects of each of these variables is acknowledged.

Non-Language I.Q. Table XXV indicates that non-language I.Q. was a factor significant at the .002 level in the increased scores achieved by higher non-language I.Q. groups in grades one and two, but again main effects of grade and mode of stimulus-response section were present. No interaction among the variables of grade, non-language I.Q. and mode of stimulus-response section was discovered. Once again however, there was an interaction between grade and mode of stimulus-response, significant at the .001 level which was affecting scores by grade and stimulus-response section.

Reading Achievement. Reading achievement had a highly significant effect (.001) on scores achieved on the Spatial Prepositions Test as indicated on Table XXVI. The higher scores for more able readers were also affected by the variables of grade and mode of stimulus-response section. Again,

TABLE XXIV

SUMMARY OF ANALYSIS OF VARIANCE BY GRADE, LANGUAGE I.Q. AND THREE MODES OF STIMULUS-RESPONSE TEST SECTIONS

SOURCE OF VARIATION	SS	DF			
Between Subjects	4309.62	79			
Grade	516.19	1	516.19	13.97	0.00*
Language I.Q.	858.69	1	858.69	23.24	0.00*
Grade x Language I.Q.	126.31	1	126.31	3.42	0.07
Subjects within Group	6453.37	160			
Mode of Stimulus-Response	4474.87	2	2237.44	193.78	0.0*
Grade x Mode	170.50	2	85.25	7.38	0.001
Language I.Q. x Mode	9187.50	2	4.60	0.40	0.67
Grade x Language I.Q. x Mode	43.75	2	21.87	1.89	0.15
Mode x Subjects within Group	1755.06	152	11.55		

* Significant at .001.

TABLE XXV

SUMMARY OF ANALYSIS OF VARIANCE BY GRADE, NON-LANGUAGE I.Q. AND THREE MODES OF STIMULUS-RESPONSE TEST SECTIONS

SOURCE OF VARIATION	SS	DF	MS	F	P
Between Subjects	4309.62	79			
Grade	516.19	1	516.19	11.82	0.00**
Non-Language I.Q.	464.69	1	464.69	10.64	0.002*
Grade x Non-Language I.Q.	9.00	1	9.00	0.21	0.65
Subjects within Group	3319.75	76	43.68		
Within Subjects	6453.37	160			
Mode of Stimulus-Response	4474.87	2	2237.44	191.60	0.0**
Grade x Mode	170.50	2	85.25	7.30	0.00**
Non-Language I.Q. x Mode	19.19	2	9.59	0.82	0.44
Grade x Non-Language I.Q. x Mode	13.18	2	6.91	0.59	0.55
Mode x Subjects within Group	1774.00	152	11.68		

* Significant at .002.
** Significant at .001.

TABLE XXVI

SUMMARY OF ANALYSIS OF VARIANCE BY GRADE, READING ACHIEVEMENT AND THREE MODES OF STIMULUS-RESPONSE TEST SECTIONS

SOURCE OF VARIATION	SS	DF	MS	F	P
Between Subjects	4309.62	79			
Grade	516.19	1	516.19	13.14	0.00*
Reading Achievement	784.69	1	784.69	19.97	0.00*
Grade x Reading Achievement	23.00	1	23.00	0.59	0.45
Subjects within Group	2985.75	76	39.29		
Within Subjects	6453.37	160			
Mode of Stimulus-Response	4474.87	2	2237.44	193.01	0.0*
Grade x Mode	170.50	2	85.25	7.35	0.00*
Reading Achievement x Mode	34.69	2	17.34	1.50	0.23
Grade x Reading x Mode	11.25	2	5.62	0.49	0.62
Mode x Subjects within Group	1762.06	152	11.59		

* Significant at the .001 level.

there was no evidence of a three-way interaction but a significant interaction between grade and mode section was found. Therefore, in addition to the main effect of reading achievement, the main effects of grade and mode section and the combined effect of these interaction variables is recognized.

Chronological Age. Table XXVII indicates that chronological age had a significant main effect of .04 on the greater number of correct responses given by the older subjects in the study. Main effects of grade and mode of stimulus-response test section were also present which reached a higher level of significance than did the effect of chronological age. As previously, a two-way interaction between grade and mode section occurred. In addition, there was a three-way interaction, significant at the .05 level, among the variables of chronological age, grade and mode section. Together, these factors were producing differences in performance of chronological age groups between grades and test sections in grades one and two.

Section Summary

The results of the analyses of variance when subjects' scores on two modes of stimulus-response sections were considered recorded significant main effects of total I.Q., language I.Q., non-language I.Q. and chronological age on scores achieved on the Spatial Prepositions Test. In addition, there were consistent main effects of grade and stimulus-

TABLE XXVII

SUMMARY OF ANALYSIS OF VARIANCE BY GRADE, CHRONOLOGICAL AGE AND THREE MODES OF STIMULUS-RESPONSE TEST SECTIONS

SOURCE OF VARIATION	SS	DF	MS	F	P
Between Subjects	4309.62	79			
Grade	516.19	1	516.19	11.23	0.001**
C.A.	209.00	1	209.00	4.55	0.04*
Grade x C.A.	91.37	1	91.37	1.99	0.16
Subjects within Group	3493.06	76	45.96		
Within Subjects	6453.37	160			
Mode of Stimulus-Response	4474.87	2	2237.44	196.73	0.0**
Grade x Mode	170.50	2	85.25	7.50	0.00**
C.A. x Mode	10.12	2	5.06	0.45	0.64
Grade x C.A. x Mode	69.12	2	34.56	3.04	0.05*
Mode x Subjects within Group	1728.75	152	11.37		

* Significant at .001.
** Significant at .05.

response section in each analysis of variance. Two-way interactions occurred between grade and mode section and between chronological age and mode section. No three-way interactions were present.

When consideration was given to inclusion of the third section of the Spatial Prepositions Test the variables of total I.Q., language I.Q., reading achievement and chronological age had significant main effects on scores obtained. As in the previous analyses section, a consistent two-way interaction occurred between grade and mode test section when each variable was examined. There was one three-way interaction, among grade, chronological age, and mode of stimulus-response section.

COMPARISON OF DIFFICULTY LEVELS OF PREPOSITIONS

In order to compare the difficulty level of prepositions of spatial position which subjects understood, the researcher analyzed each child's responses by hand using the z test of differences between proportions (Ferguson, 1959). Criterion scores differed from those of previous analyses in that only fully correct responses were considered. Partial answers given credit in the Verbal (Oral) — Non-Verbal and Reading — Non-Verbal sections, and plausible and partial answers credited in the Verbal (Oral) — Verbal (Oral) section were not included as information was sought with respect

to the accuracy with which subjects demonstrated understanding in their placements and identification using prepositions of spatial position. Two separate analyses were conducted including comparisons of prepositions understood between modes of stimulus-response test sections in each grade and comparisons of prepositions understood within each mode section in each grade. For all analyses, a z value of 1.96 was required for a significance level of .05.

Proportion of Subjects Scoring Correct on Each Preposition Tested Between Modes of Stimulus-Response Test Sections

The proportion of subjects with each preposition correct when modes of stimulus-response sections were compared for each grade separately are shown in Table XXVIII. The z values compiled on this table were arrived at in the following manner. The numbers of pupils in each grade who passed one test mode section and failed the other, failed one mode section and passed the other, passed both test sections, and failed both sections was counted. The four numbers thus calculated were then processed by computer service at the University of Alberta to obtain the z values indicated. In interpreting the table, the numerical value shown indicates the level of significance. If preceded by a minus sign, the first named stimulus-response section in each column is indicated as more difficult; and if preceded by a plus sign, the reverse is true. Plus and minus signs indicate only which

TABLE XXVIII

PROPORTION OF SUBJECTS WITH EACH PREPOSITION CORRECT BETWEEN MODE TEST SECTIONS

Preposition	K	1			2		
	M_2 vs M_1	M_2 vs M_1	M_2 vs M_3	M_1 vs M_3	M_2 vs M_1	M_2 vs M_3	M_1 vs M_3
above	-4.08	-5.38	-4.02	+2.52	-5.66	-4.38	+3.05
below	-2.53	-4.36	-3.21	+1.94	-4.58	-4.24	+0.83
in front of	-3.96	-5.11	-3.00	+3.60	-3.71	-2.36	+1.94
behind	-1.61	-3.00	-2.40	+0.38	-3.00	-3.00	0.00
inside	-5.29	-5.92	-5.40	+1.63	-5.48	-5.57	-0.45
over	-0.69	-3.71	-4.24	-0.45	-2.06	-3.36	-1.63
beside	+1.96	+1.34	+3.15	+2.33	+1.60	+1.53	+0.24
underneath	-5.83	-5.66	-5.29	+1.07	-5.91	-5.83	+0.38
around	+1.88	-4.08	-2.52	+2.71	-0.23	-1.60	-1.39
through	-3.60	-1.70	-2.84	-1.41	-0.30	-2.11	-2.45
on the right of	+0.90	-1.26	+2.53	+3.46	+1.96	+1.88	-0.30
between	-4.20	-4.38	-3.67	+0.73	-4.49	-4.80	-0.33
out of	-2.00	-2.11	+3.54	+4.90	-2.11	+2.67	+3.90
near	-5.57	-5.57	-5.10	+1.15	-5.20	-4.90	+0.69
across	-3.58	-5.00	-3.44	+3.16	-4.60	-4.50	+0.33
on the left of	-1.39	-1.50	-1.73	0.00	-1.50	-1.73	0.00
on	-4.38	-4.00	-2.84	+2.24	-4.47	-4.47	-1.00
on top of	-2.11	-4.00	-3.36	+1.73	-1.51	-2.83	-1.73
outside	-1.55	-4.80	-4.38	+0.63	-2.68	-2.84	-0.28
beneath	-4.36	-4.90	-4.90	0.00	-4.71	-5.20	-0.78

z = 1.96 required for significance at .05 level.
2.58 required for significance at .01 level.
3.09 required for significance at .001 level.

M_2 = V(O) — V(O) M_1 = V(O) — N.V. M_3 = Rdng. — N.V.

mode section is more difficult when sections are compared. For example, the z value obtained for above in kindergarten, -4.08, means that when the Verbal (Oral) — Verbal (Oral) test section was compared with the Verbal (Oral) — Non-Verbal section, a greater proportion of pupils found above more difficult in the Verbal (Oral) — Verbal (Oral) section of the Spatial Prepositions Test.

Kindergarten. When the difficulty level of a preposition in the Verbal (Oral) — Non-Verbal task was compared with the same preposition in the Verbal (Oral) — Verbal (Oral) task, a significantly greater proportion of subjects understood the preposition in the Verbal (Oral) — Non-Verbal task. That is, for most kindergarten subjects, it was more difficult to use the preposition of spatial position accurately in speech than to identify correct spatial position from the preposition non-verbally. Beside, significant at the .05 level, and around were exceptions that were found to be more difficult when demonstrating accurate placement of spatial position non-verbally. Over and on the right of proved to be about equally difficult, regardless of the stimulus-response mode section employed. Behind, on the left of and outside were more difficult for the greater proportion of subjects in the Verbal (Oral) — Verbal (Oral) test, but the difference between proportions for the two mode sections was not significant. The results are given in Table XXVIII.

Grade One. A close examination of the results for

grade one on Table XXVIII indicates a general pattern emerging in which a larger proportion of pupils had each preposition correct first on the Verbal (Oral) — Non-Verbal, second on the Reading — Non-Verbal, and third on the Verbal (Oral) — Verbal (Oral) modes of stimulus-response sections. Within this pattern of proportions, differences in favor of the Verbal (Oral) — Non-Verbal mode and significant at the .05, .01 and .001 levels respectively include the following prepositions:

.05	.01	.001
above	around	in front of
beside		on the right of
on		out of
		across

With the exception of out of and on the right of where more difficulty was suggested in the Reading — Non-Verbal stimulus-response, the other prepositions tested presented no significant difference in difficulty level, whether encountered in oral or in printed content. Through and beside were substantially less difficult to demonstrate in the oral reading situation than in the other forms of stimulus-response utilized. Little or no differences were found for on the left of when mode sections were compared for grade one subjects.

Grade Two. Table XXVIII reveals a number of facts concerning the levels of difficulty of prepositions of spatial

position between mode sections for grade two subjects. As was noted in grade one, a similar pattern exists with the Verbal (Oral) — Verbal (Oral) stimulus-response mode section most difficult and the Verbal (Oral) — Non-Verbal test mode least difficult but the pattern holds for fewer prepositions. In grade one, thirteen prepositions were found to follow this typical pattern, whereas in grade two there were only eight.

Another major difference in grade two is revealed in the number of prepositions where the difference between proportions was significant. When the number of these prepositions was counted for each grade the following differences were found:

	V(O)-V(O)	vs	V(O)-N.V.	V(O)-V(O)	vs	Rdng.-N.V.	V(O)-N.V.	vs	Rdng.-N.V.
K			14						
1			16			19			8
2			15			16			3

A decrease is immediately observed in the number of prepositions where significant differences were found when the Verbal (Oral) — Non-Verbal test section was compared with the Reading — Non-Verbal section. Only three such prepositions were found in grade two whereas in grade one there were eight. All of the prepositions indicated in the above column in grades one and two were less difficult in the Verbal (Oral) — Non-Verbal section. This would suggest that

grade one subjects experience more difficulty comprehending the concept of spatial position when reading orally than do pupils in grade two.

Differences in difficulty levels between mode sections based on the proportion of subjects in grade two who provided correct responses were slight or negligible for beside, around and on the left of. Through was most readily demonstrated when reading was involved and on the right of was significantly less difficult in the Verbal (Oral) — Non-Verbal testing situation only when this mode section was compared with the Verbal (Oral) — Verbal (Oral) test (Table XXVIII, column I in grade two).

Table XXIX presents an ordering of the difficulty level of the prepositions from the highest to lowest z value as given in Table XXVIII. Thus, number one represents the preposition where the greatest difference between test sections was shown and number twenty represents the prepositions where the least difference was found.

It will be noticed that in kindergarten and grade one the greatest differences were found with underneath, near and inside when the Verbal (Oral) — Verbal (Oral) stimulus-response section was compared with the Verbal (Oral) — Non-Verbal section. In grade two, a similar but slightly different pattern existed when these prepositions were compared between sections. It is interesting that when the Verbal (Oral) — Non-Verbal test section was compared with the

TABLE XXIX

ORDER OF DIFFICULTY LEVEL OF PREPOSITIONS

BETWEEN TEST SECTIONS BY GRADE

Preposition	K	1			2		
	M_2 vs M_1	M_2 vs M_1	M_2 vs M_3	M_1 vs M_3	M_2 vs M_1	M_2 vs M_3	M_1 vs M_3
underneath	1	2	2	14	1	1	13
near	2	3	3	13	4	4	11
inside	3	1	1	11	3	2	12
on	4	12*	15*	8	9	7	8
beneath	5	7	4	19*	5	3	10
between	6	9	8	15	8	5	14*
above	7	4	7	6	2	8	2
in front of	8	5	14	2	10	15	4
through	9	17	15*	12	19	16	3
across	10	6	10	4	6	6	14*
below	11	10	12	9	7	9	9
on top of	12	12*	11	10	17	13	5
out of	13	16	9	1	13	14	1
beside	14	19	13	7	16	20	18
around	15	11	18	5	20	19	7
behind	16	15	19	18	11	11	19*
outside	17	8	5	16	12	12	17
on the left of	18	18	20	19*	18	18	19*
on the right of	19	20	17	3	15	17	16
over	20	14	6	17	14	10	6

* equal in value.

M_2 = V(O) — V(O) M_1 = V(O) — N.V. M_3 = Rdng. — N.V.

Reading — Non-Verbal section (column 3), the difference between mode sections was much less for the above prepositions. On the left of is an example of a preposition where small differences between test sections were consistently found regardless of which two sections were examined.

Across the grades, there is a lack of consistency in order of difficulty and thus no aspects of development are indicated except in isolated instances. Development may be suggested with near where difference between sections becomes less from grade to grade when the same test portions were compared.

Section Summary

Analysis of correct responses on the basis of the proportion of subjects who got each preposition correct between mode sections indicated that a range of difficulty levels was evident when modes of stimulus-response sections were compared. When considering total scores by mode sections, there was a significant difference between the Verbal (Oral) — Verbal (Oral) and Verbal (Oral) — Non-Verbal modes of stimulus-response sections for kindergarten, grades one and two and between the Reading — Non-Verbal stimulus-response and the other two mode test sections for grades one and two. In general, greater accuracy was demonstrated by subjects when the Verbal (Oral) — Non-Verbal mode was employed than in the Verbal (Oral) — Verbal (Oral) mode. Grades one and two

pupils performed at a lower level on the Reading — Non-Verbal aspects of the test when compared with the Verbal (Oral) — Non-Verbal test mode but demonstrated greater skill in the Reading — Non-Verbal test aspects than in the Verbal (Oral) — Verbal (Oral) test items. A decrease was revealed in grade two in the number of prepositions that adhered to the general pattern and in the number of these prepositions that were shown to be statistically significant.

When the difference between proportions between mode test sections was ordered according to the level of difficulty of the preposition, no consistent pattern was found. However, the greatest differences between test sections were consistently found for underneath, near and inside in kindergarten and grade one when the Verbal (Oral) — Non-Verbal section was compared with the Verbal (Oral) — Verbal (Oral) section. A similar situation was revealed in grades one and two when the Verbal (Oral) — Non-Verbal test section was compared with the Reading — Non-Verbal section. Small differences in proportions were evident for on the left of in each grade when the mode sections were compared.

Proportion of Subjects Scoring Correct on Each Preposition Tested Within Each Mode of Stimulus-Response Section

A comparison of the difference between proportions within each mode was made by conducting a separate analysis

for each preposition in the test. As when the difference of proportions between mode sections was determined, a similar procedure was employed. The results of this analysis have been condensed and summarized in table form (Tables XXX, XXXI, XXXII) for each grade. These tables show the number of prepositions found to be significantly more difficult, the number significantly less difficult and the number where there was no significant difference when prepositions were compared. For example, above in kindergarten (Table XXX) was revealed to be more difficult than seven other prepositions, less difficult than three prepositions and there was no significant difference in difficulty level for nine other prepositions in the Verbal (Oral) — Verbal (Oral) test.

Kindergarten. In the Verbal (Oral) — Verbal (Oral) stimulus-response section, on top of was clearly the least difficult of the prepositions tested (Table XXX). For a greater proportion of kindergarten subjects, it was less difficult than seventeen other prepositions and no significant difference was found when compared with two others, namely, beside and out of. Of the group of seventeen prepositions, the difference between proportions was significant at the .001 level for all except behind, on and through. The significance levels for behind and on were .01 and for through, .05. Thus, kindergarten subjects not only understood the spatial position represented by on top of but used

TABLE XXX

COMPARISON OF PREPOSITIONS CORRECT WITHIN EACH MODE SECTION BY KINDERGARTEN PUPILS

	V(ORAL) — V(ORAL)			V(ORAL) — N. VERBAL		
	More Than	Less Than	No Difference	More Than	Less Than	No Difference
above	7	3	9	3	8	8
below	10	0	9	14	0	5
in front of	3	10	6	0	11	8
behind	1	11	7	4	9	6
inside	9	2	8	0	10	9
around	3	8	8	15	0	4
underneath	11	1	7	0	11	8
beside	1	14	4	10	3	6
over	4	7	8	10	2	7
through	1	11	7	1	9	9
on the right of	11	1	7	12	2	5
between	10	2	7	5	5	9
out of	0	13	6	1	8	10
near	13	2	4	2	8	9
across	10	1	8	10	2	7
on the left of	8	3	8	12	1	6
on	2	9	8	0	14	5
on top of	0	17	2	0	12	7
outside	5	4	10	11	3	5
beneath	14	1	4	10	4	5

TABLE XXXI

COMPARISON OF PREPOSITIONS CORRECT WITHIN EACH MODE SECTION BY GRADE ONE PUPILS

	V(O) - V(O)			V(O) - N.V.			Rdng. - N.V.		
	More Than	Less Than	No Difference	More Than	Less Than	No Difference	More Than	Less Than	No Difference
above	7	4	8	8	4	7	6	3	10
below	13	0	6	13	2	4	13	3	3
in front of	8	4	7	2	7	10	5	5	9
behind	3	10	6	6	3	10	4	5	10
inside	9	2	8	1	11	7	1	13	5
around	3	8	8	2	5	12	5	5	9
underneath	12	0	7	2	5	12	4	6	9
beside	3	9	7	16	1	2	17	1	1
over	1	12	6	0	8	11	0	15	4
through	0	15	4	3	5	11	0	15	4

TABLE XXI (CONTINUED)

	V(O) - V(O)			V(O) - N.V.			Rdng. - N.V.		
	More Than	Less Than	No Difference	More Than	Less Than	No Difference	More Than	Less Than	No Difference
on the right of	5	3	9	16	0	3	18	0	1
between	6	5	8	5	4	10	5	5	9
out of	0	16	3	0	10	9	13	2	4
near	15	0	4	4	4	11	5	5	9
across	8	2	9	6	4	9	7	2	10
on the left of	8	4	7	16	0	3	13	2	4
on	0	12	7	0	15	4	1	13	5
on top of	7	3	9	5	4	10	4	6	9
outside	7	3	9	5	4	10	4	6	9
beneath	15	0	4	9	3	7	5	5	9

TABLE XXXII

COMPARISON OF PREPOSITIONS CORRECT WITHIN EACH MODE SECTION BY GRADE TWO PUPILS

	V(O) - V(O)			V(O) - N.V.			Rdng. - N.V.		
	More Than	Less Than	No Difference	More Than	Less Than	No Difference	More Than	Less Than	No Difference
above	11	1	7	0	8	11	9	3	7
below	16	0	3	13	2	4	12	0	7
in front of	5	7	7	1	5	13	8	3	8
behind	0	9	10	0	7	12	0	10	9
inside	11	14	4	0	7	12	0	10	9
around	0	11	8	7	2	10	3	5	11
underneath	15	0	4	1	8	10	2	8	9
beside	4	7	8	17	0	2	16	0	3
over	0	11	8	1	6	12	0	11	8
through	0	14	5	2	4	13	0	10	9

TABLE XXXII (CONTINUED)

	V(O) - V(O)			V(O) - N.V.			Rdng. - N.V.		
	More Than	Less Than	No Difference	More Than	Less Than	No Difference	More Than	Less Than	No Difference
on the right of	3	7	9	18	0	1	16	0	3
between	8	4	7	1	5	13	2	9	8
out of	3	10	6	0	9	10	11	2	6
near	15	0	4	7	2	10	9	2	8
across	11	4	4	4	4	11	7	4	8
on the left of	5	4	10	12	2	5	15	0	4
on	4	8	7	0	14	5	0	14	5
on top of	0	15	4	0	7	12	0	14	5
outside	3	8	8	1	4	14	2	7	10
beneath	15	0	4	10	2	7	7	4	8

the term readily in speech. Other prepositions easily understood and expressed verbally were out of, behind, beside and through.

As the table indicates, kindergarten children experienced difficulty when the spatial positions of beneath and near were demonstrated. Responses offered suggested awareness of the meaning of these prepositions but the terms were not a part of the spontaneous vocabulary of the majority of these subjects. It was noted during testing that under was commonly substituted for beneath and near was often described by using beside or by offering a verbal explanation such as on the side.

When prepositions were compared in the Verbal (Oral) — Non-Verbal portion of the test, around and below proved most difficult when demonstration of accurate meaning was required. Positions indicated in testing by many of the subjects revealed that these prepositions were not accurately understood. In the sentence, "The boy runs around the tree", a common procedure was to set the boy down somewhere in the vicinity of the tree. Similarly, when placing the ball below the see-saw was called for, subjects tended to place the ball beside or near the see-saw rather than under in place.

The prepositions which presented less difficulty when compared with other prepositions in the oral - non-verbal sec-

tion of the test were on and on top of, underneath, through and in front of, in that order. The levels of significance of these prepositions, where 3.09 was required for significance at the .001 level, are as follows:

on, on top of - 5.66

underneath - 5.21

through - 5.20

in front of - 5.05

It is interesting to note that on top of ranked first in less difficult prepositions in both modes of stimulus-response sections in kindergarten. The findings of McLeod (1969) that only out was understood by all kindergarten subjects was not confirmed in the present research.

Grade One. Similar to the pattern in kindergarten, beneath and near posed the most difficulty for pupils in grade one (Table XXXI) in the Verbal (Oral) — Verbal (Oral) section. They were found to be equally difficult for a greater proportion of the subjects, and each were more difficult than fifteen other prepositions. A breakdown of the less difficult prepositions according to significance levels is as follows:

.05	.01	.001
inside	in front of	behind
across	on the right of	around
	on the left of	underneath
	outside	beside
		over
		through
		out of
		on
		on top of

As can be observed nine out of the fifteen prepositions were significantly less difficult at the .001 level than either near or beneath.

The prepositions out of, through, on and over were the least difficult prepositions in this stimulus-response mode section. With the exception of out of, none of these appeared on the less difficult preposition list for kindergarten.

It will be noted that in the Verbal (Oral) — Non-Verbal section of the test, three prepositions proved equally difficult for grade one pupils - beside, on the right of and on the left of. The only difference that occurred among these three prepositions was that beside was also found to be less difficult than above, the difference between proportions being 4.38.

On was easily the spatial position demonstrated accurately by the largest proportion of grade one pupils, but out of and over were also successfully handled with ease by most of these subjects.

The concepts, on the right of and beside, as presented in printed form in the Reading — Non-Verbal test section were difficult to comprehend in grade one. These concepts and terms proved more difficult than eighteen and seventeen other test items respectively. Again, when beside was compared with above, beside presented less difficulty for pupils.

It is noted that on the left of which was equally as difficult as on the right of and beside in the oral - non-verbal section was not as difficult when encountered in the oral reading situation. On the right of was found to be significantly more difficult, at the .001 level, in reading than was on the left of, and beside was significantly more difficult than on the left of, at the .05 level. On the left of, however, was found to be more difficult than thirteen other prepositions, as was below, and out of. Thus, these prepositions appear to cause considerable difficulty in comprehension of accurate meaning when reading.

Prepositions most readily understood by pupils in grade one in the reading situation in this study included first over and through and then inside and on in that order of less difficulty.

Grade Two. Table XXXII shows four prepositions were

considerably more difficult than others in the Verbal (Oral) — Verbal (Oral) mode of stimulus-response section when comparisons were made - below, beneath, underneath and near. While a larger proportion of grade two pupils found below more difficult, there was no significant difference when below was compared with underneath, near and beneath. Above, however, was less difficult than below but on a par level of difficulty with underneath, near and beneath. A tendency for pupils to use other terms in describing spatial position was demonstrated when the above test items were involved.

Less difficult prepositions in order of difficulty in the Verbal (Oral) — Verbal (Oral) section were on top of, through, around and over (equal), and behind.

Essentially, with the omission of one preposition, on the left of, the pattern of more difficulty in grade two was identical to that of grade one in the Verbal (Oral) — Non-Verbal stimulus-response section. That is, on the right of and beside continued to be the more difficult prepositions when demonstration of the spatial position represented was required. On the left of, while still more difficult than twelve other prepositions with which it was compared, apparently posed less difficulty for grade two pupils than for the grade one group. Below was also indicated as a difficult preposition in this stimulus-response section, as was also found for grade one. Thus, there appears to be an insignificant difference in performance between grades one and two pupils in so

far as difficult prepositions are concerned.

When consideration is given to less difficult prepositions, a noticeable increase in the number of such prepositions is observed in grade two. This is illustrated in the following list of specific prepositions found less difficult in grades one and two in this section of the test:

1	2
on	out of
out of	above
over	behind
	inside
	on
	on top of

A look at Tables XXX, XXXI and XXXII reveals that this same general pattern prevails across the grades for the Verbal (Oral) — Verbal (Oral) stimulus-response and for grades one and two in the Reading — Non-Verbal mode of stimulus-response.

Aspects of development are also suggested when the number of prepositions where no significant difference was found between prepositions is examined in the Verbal (Oral) — Non-Verbal columns. It will be noted that there is a substantial increase in the number of these prepositions in grades one and two as compared to the number in kindergarten.

When the difference between proportions was determined within the Reading — Non-Verbal stimulus-response, beside and

on the right of emerged as more difficult prepositions, similar to the pattern in grade one. Unlike grade one, however, on the left of presented almost as much difficulty when reading as did beside and on the right of. Below and out of continued to be difficult concepts to comprehend at the grade two level. It is interesting to note on Table XXXII that out of was a difficult concept to understand in the reading task but presented little difficulty in the other two portions of the test. As can be seen on Table XXXI, this finding held true for grade one subjects as well.

Based on the proportion of subjects who found prepositions less difficult in reading, the investigator found the following six prepositions: out of, above, behind, inside, on and on top of. As mentioned previously, this represents an increase over findings in grade one where only three prepositions were found with a similar low level of difficulty.

Section Summary

As indicated by the findings of this investigation, levels of difficulty obtained when each preposition was compared with every other preposition within each mode varied with grade and mode of stimulus-response section. However, consistent patterns of difficulty reappeared in many of both more difficult and less difficult prepositions. Near and beneath remained the more difficult prepositions in the Verbal (Oral) — Verbal (Oral) stimulus-response test section in

kindergarten, grades one and two. On the right of was representative of a difficult preposition common to all subjects in the Verbal (Oral) — Non-Verbal mode of stimulus-response section and beside and on the right of were consistently difficult for pupils in grades one and two in the Reading — Non-Verbal portion of the test. Specific prepositions which were generally less difficult for subjects in the test sample included out of and on top of in the Verbal (Oral) — Verbal (Oral) section, on and out of in the Verbal (Oral) — Non-Verbal test section and on, through and over in the Reading — Non-Verbal portion of the test.

TEST OBSERVATIONS AND ADDITIONAL FINDINGS

Several observations made by the investigator during the individual testing sessions provide additional information with respect to the subjects' approach to the problems presented to them.

Generally speaking, as might be expected, grade two subjects handled test items more quickly and confidently. Kindergarten subjects were much slower in responding and more prompting was necessary to elicit responses.

Repetition of key words, phrases, and whole sentences by pupils either whispered or aloud, was a common occurrence throughout the non-verbal tasks. When sentences were read aloud, there was a tendency of the pupils to glance back at

the sentence silently before attempting a response. It appeared that children required this means of additional reinforcement to assist their memory.

There was evidence of general right and left confusion in the subjects tested. Some children had these concepts completely reversed with reference to both self and the external world. Others could identify their right and left hands but were unable to relate this knowledge to the external world of objects in the testing situation. More often children demonstrated partial understanding of the concepts of 'right' and 'left'. To these children right and left of the school apparently meant the right and left front corners of the school yard or school. Aspects of development were noted in that kindergarten children had difficulty in identifying their right and left hands, more grade one children were able to do this readily and by grade two the problem was not identification with reference to themselves but with reference to the model and the objects manipulated.

Some children exhibited what seemed to be obvious signs of guessing. They would pause, ponder and look puzzled after the stimulus was given. Before responding, these children would first look to the investigator for some hint or encouragment, then place the object and say, "right here?". When the stimulus was repeated in statement form for each test item many of these subjects changed their placement, even if it had been correctly placed the first time. Others, however, made

no attempt to evaluate or change their placements. When uncertainty or reticence on the part of subjects was noted and followed up by questioning the meaning of the preposition, the reply sometimes given was "I don't know" or "I forget" or "I know but I can't tell it".

It became apparent almost from the beginning that children were aware that it was spatial position that was being tested. Concentration seemed to center on the position indicated in the sentence to the exclusion of the meaning of other words in the sentence. For example, in the Verbal (Oral) — Non-Verbal test section, in the sentence, "The boys walk in front of the school", the boys were simply stood up in front of the school with no action indicated. When the sentence, "Jack is riding his bicycle in front of Tom" was read, again the bicycle was placed in a stationary position in front of Tom with no attempt to demonstrate motion. One other example of this was shown in the reading section in the sentence, "The airplane went over the school", where the airplane was held suspended in mid-air over the school building.

During the Verbal (Oral) — Verbal (Oral) stimulus-response portion of the test, the researcher noted a lack of precision in responses given by subjects. One-word answers and partial answers such as "up", "above", "right", "in the air", "on the table", and "in the middle" were prevalent. Further probing resulted in either no response or in a more accurate placement.

Substitute prepositions while not used frequently, were nevertheless present in children's speech in describing spatial position. For instance, when the ball was held over the child's head and the child was asked where the ball was, many subjects responded by saying "on my head". "On" and "beside" were over-worked prepositions generally used to describe positions that children were unsure of. The use of substitute prepositions is cited by Menyuk (1969) as an earlier stage of development in the use of terms denoting concepts.

Pointing to assist description was also employed by subjects at each grade level but was not a widespread occurr-ence. This indicates an early stage of concept development according to Ames and Learned (1948) who observed a looking, pointing, verbalizing sequence in a study of verbalized space with nursery school children.

These observations give some indication of the behavior of the children tested and their reactions to the testing situation.

SUMMARY

This chapter has presented the findings from a study of the understanding of prepositions of spatial position by kindergarten, grades one and two children. Results of the three-way analyses of variance revealed that the variables of intelligence, chronological age and reading achievement

very important influences on children's scores in all modes of stimulus-response sections. Grade and mode test section had both a significant main effect and combined interaction effect on pupils' responses. There was no significant difference between boys and girls in performance on the prepositions test, however. Furthermore, socio-economic status by itself failed to be statistically significant in affecting subjects' scores.

Findings of the correlational analyses which attempted to determine the extent of the relationship existing between scores on each section of the prepositions test and the independent variables of intelligence, chronological age, socio-economic status and reading achievement were presented and discussed. In addition, difficulty levels of prepositions when comparisons were made between mode sections and within mode of stimulus-response sections were examined. Further findings observed during the testing sessions were also included.

CHAPTER V

SUMMARY, CONCLUSIONS, IMPLICATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

The purpose of this research was to investigate whether children in kindergarten, grades one and two understood selected prepositions of spatial position. It examined whether these children understood the concept of spatial position when utilizing three modes of stimulus-response. One of the modes required that children demonstrate understanding of prepositions of spatial position after reading a sentence orally. In addition to this, information was sought as to whether there was a significant increase in comprehension of prepositions of spatial position at successive grade levels. This would lend support to the postulation that the attainment of the concept of spatial position by young children is developmental.

This chapter presents a brief summary of the study, the main findings, and the conclusions drawn from them. Implications for reading and suggestions for further research are discussed.

SUMMARY OF STUDY

From the total population of all children attending kindergarten in the experimental classrooms in the City of

Edmonton, and all children enrolled in grades one and two in the Edmonton Public School System, forty children were randomly selected at each grade level, yielding a total test sample of 120 subjects. The subjects were drawn from two schools and two kindergartens designated by school board officials as being in a low and high socio-economic status area. The sample was further stratified to include equal number of boys and girls at each grade level.

A socio-economic status rating was obtained by combining and averaging the parents' scores on the Socio-Economic Index for Occupations, 1961 (Blishen, 1968).

Intelligence test scores were determined for each subject by administering the California Short Form-Test of Mental Maturity. Level 0 was used for the kindergarten subjects and Level 1 for all grades one and two subjects.

A measure of reading achievement for each of the grades one and two subjects was obtained from the Gates-MacGinitie Reading Tests-Primary A and B; Level A for grade one and Level B for grade two.

Understanding of the concept of spatial position was examined by means of a Spatial Prepositions Test designed by the investigator. This test consisted of three separate sections, each designed to measure pupil performance on a different stimulus-response mode. One mode section measured understanding of prepositions of spatial position in listening and then responding by correct placement; a second measured ability

to recognize and identify spatial position by using accurately prepositions of spatial position; and a third measured understanding of these prepositions when grades one and two subjects read sentences orally and responded by correct placement. Twenty prepositions were tested in each test section and subjects were tested individually.

The data collected were analyzed by computer services at the University of Alberta using the statistical measures of three-way analysis of variance and computations of correlation coefficients. An additional analysis was carried out by hand by the investigator on the difficulty level of prepositions using correlated z values for difference between proportions. The findings from each of the hypotheses tested follow.

MAIN FINDINGS

Hypothesis 1

There is no significant interaction between

(a) Sex and mode of stimulus-response

(b) Grade and mode of stimulus-response

(c) Reading achievement and mode of stimulus-response

(d) Socio-economic status and mode of stimulus-response on the understanding of prepositions as tested by the Spatial Prepositions Test.

Statistical analysis indicated that two-way interaction

occurred between grade and mode of stimulus-response section which was significant at the .001 level, but no other interaction was found among the variables tested. Grade and stimulus-response section together however were significantly affecting children's scores when sex, reading achievement and socio-economic status was considered resulting in a variation of scores of these groups. Therefore, hypothesis 1 (b) was rejected while hypothesis 1 (a), (c) and (d) were accepted.

Hypothesis 2

There is no significant difference between scores of children in kindergarten, grades one and two first on the Verbal (Oral) — Non-Verbal section and then on the Verbal (Oral) — Verbal (Oral) mode of stimulus-response section of the Spatial Prepositions Test.

The mean grade scores of the pupils in the Verbal (Oral) — Verbal (Oral) mode of stimulus-response section showed an increase in the ability of children at successive grade levels to demonstrate understanding of prepositions of spatial position when using this mode. Although the mean score of pupils in grade one was higher than that of the kindergarten group, and the mean score of grade two pupils was higher than the mean score of grade one pupils, only the difference between the mean scores of grades one and two was statistically significant. The gradual increase in mean scores on this section of the test achieved significance over the period of two years,

in grade one was higher than that of the kindergarten group, and the mean score of grade two pupils was higher than the mean score of grade one pupils, only the difference between the mean scores of grades one and two was statistically significant. The gradual increase in mean scores on this section of the test achieved significance over the period of two years, from kindergarten to grade two.

On the basis of these findings, hypothesis 2 was rejected.

Hypothesis 3

There was no significant difference in children's scores between the Verbal (Oral) — Non-Verbal and Verbal (Oral) — Verbal (Oral) modes of stimulus-response sections of the Spatial Prepositions Test.

Children in each grade scored significantly higher on the Verbal (Oral) — Non-Verbal test section than on the Verbal (Oral) — Verbal (Oral) mode of stimulus-response section. The null hypothesis was rejected.

Hypothesis 4

There is no significant difference between test scores of children on each of the Verbal (Oral) — Non-Verbal, Verbal (Oral) — Verbal (Oral) and Reading — Non-Verbal modes of stimulus-response sections of the Spatial Prepositions Test for grades one and two subjects.

Findings indicated that subjects' scores in grades one

and two were higher on the Verbal (Oral) — Non-Verbal task than on the Verbal (Oral) — Verbal (Oral) test task. Scores obtained on the Reading — Non-Verbal test items were lower than the Verbal (Oral) — Non-Verbal scores but higher than those achieved on the Verbal (Oral) — Verbal (Oral) test items. The difference between scores on the Reading — Non-Verbal and Verbal (Oral) — Non-Verbal tests was less in grade two than in grade one.

Thus, children were able to demonstrate knowledge of prepositions of spatial position on the Verbal (Oral) — Non-Verbal mode test more efficiently than on either the Verbal (Oral) — Verbal (Oral) mode test or the Reading — Non-Verbal test portion. The mode of stimulus-response has a significant effect, at the .001 level, on children's ability to understand prepositions of spatial position. Therefore, hypothesis 4 was rejected.

Hypothesis 5

There is no significant difference in each stimulus-response mode between test scores on the Spatial Prepositions Test of

(a) boys and girls in each grade

(b) subjects of higher and lower socio-economic status in each grade

(c) subjects of high and low intelligence in each grade

(d) subjects of high and low reading achievement in grades one and two.

Results of the investigation disclosed that there was no significant difference between boys and girls in each grade on test scores achieved on each mode section of the Spatial Prepositions Test.

A similar finding was revealed when scores of higher and lower socio-economic status subjects in each grade were considered in each mode section. When the mean scores of the Verbal (Oral) — Verbal (Oral) and Verbal (Oral) — Non-Verbal sections only were analyzed, differences in favor of higher socio-economic subjects were found, but the differences were not significant. The greatest difference between the scores of these groups occurred in grade one. However, as Table VIII indicates, the difference between the means of SES for grade one is also higher than that of other grades which may account for the increased difference in scores.

Total I.Q. was a significant factor, at the .001 level, in subjects' scores obtained on each portion of the Spatial Prepositions Test. Children with higher intelligence quotients scored consistently higher than children with lower intelligence quotients. Thus, total I.Q. was found to be a predictor of success on test scores achieved by subjects.

Reading achievement proved to be a factor in subjects' responses on the Spatial Prepositions Test for each of the stimulus-response mode sections in grades one and two. High reading achievement groups performed better than groups with low reading achievement scores.

More difference was revealed between scores of these groups in the Verbal (Oral) — Verbal (Oral) and the Reading — Non-Verbal mode sections than in the Verbal (Oral) — Non-Verbal section.

In the light of these findings, hypothesis 5 (a) and (b) were accepted and 5 (c) and (d) were rejected.

Hypothesis 6

There is no significant correlation between pupils' scores on items testing selected prepositions for each stimulus-response mode section in each grade and

(a) intelligence

(b) chronological age

(c) socio-economic status

(d) reading achievement (grades one and two only).

In grades one and two, there was a significant correlation at the .001 level between intelligence and performance on the Spatial Prepositions Test in all three modes of stimulus-response. In kindergarten, intelligence was significantly correlated with ability to perform on the Verbal (Oral) — Verbal (Oral) portion of the test only, and when total scores were considered. When the total test sample was given consideration, pupils with higher intelligence scored better than pupils with lower intelligence on the Verbal (Oral) — Verbal (Oral) section.

Chronological age was found to be significantly related

to ability to understand prepositions of spatial position in grade two in all test aspects except in the Reading — Non-Verbal section. In the total test sample, a significant relationship at the .001 level was found to exist between chronological age and ability to demonstrate understanding of prepositions of spatial position in the Verbal (Oral) — Verbal (Oral), Verbal (Oral) — Non-Verbal modes of stimulus-response, and when total scores were given consideration. The older subjects in this study generally made higher scores than did the younger ones.

No significant correlation was found at any grade level nor when the total test sample was examined between socio-economic status and performance on the Spatial Prepositions Test.

A positive relationship of substantial magnitude was found between reading achievement as measured in this study and ability to demonstrate understanding of prepositions of spatial position by grades one and two subjects. The more able readers performed at a higher level to less able readers in each stimulus-response mode section separately and on the total test. Levels of significance of the correlation coefficients for the three test portions and total scores were .001, .002, .002 and .001, in that order. In grade two the following levels were lower but still statistically significant: .02, .003, .01 and .001.

As a result of these findings, hypothesis 6 (a), (b),

and (d) were rejected and 6 (c) was accepted.

Hypothesis 7

There is no significant difference in the difficulty level of the prepositions where level of difficulty is defined to be the proportion of pupils in each grade who score correct on each preposition tested between modes of stimulus-response sections of the Spatial Prepositions Test.

Differences ranging from negligible to significant at the .001 level were found when the difficulty level of the prepositions between mode sections was subjected to statistical measurement. At the kindergarten level a greater proportion of subjects scored correct on each preposition tested on the Verbal (Oral) — Non-Verbal test than on the Verbal (Oral) — Verbal (Oral) test. In grades one and two, a pattern seemed to be established in which a greater proportion of subjects got each preposition correct on the Verbal (Oral) — Non-Verbal than on the Verbal (Oral) — Verbal (Oral) mode of stimulus-response section and the proportion of subjects who scored correct on each preposition tested on the Reading — Non-Verbal aspects was less than that on the Verbal (Oral) — Non-Verbal test aspects. These findings led to the rejection of hypothesis 7.

Hypothesis 8

There is no significant difference in the difficulty

level of the prepositions where level of difficulty is defined to be the preportion of pupils in each grade who score correct on each preposition tested within each mode of stimulus-response section of the Spatial Prepositions Test.

The z test of differences between proportions indicated that there were differences ranging from no statistically accepted significance to beyond the .001 level between the difficulty level of the prepositions tested which shifted with mode of stimulus-response section. Prepositions found consistently difficult for a larger proportion of subjects within each mode included near and beneath in the Verbal (Oral) — Verbal (Oral) stimulus-response mode, on the right of in the Verbal (Oral) — Non-Verbal mode and beside and on the right of in the Reading — Non-Verbal stimulus-response. On the basis of these findings, the above null hypothesis was rejected.

CONCLUSIONS

On the basis of the results of this investigation the following conclusions may be drawn and may be applicable to similar groups of children when tested on the same instruments.

(1) Understanding of spatial position and in competence in expressing understanding verbally appears to be developmental from kindergarten to grade two as indicated by a gradual upward progression in test scores on the Spatial Prepositions Test at each successive grade level.

(2) Understanding of the concept of spatial position by grade as demonstrated in this study varies with the mode of stimulus-response of the Spatial Prepositions Test employed.

(3) Within this variation in understanding, there is a discrepancy between children's ability to demonstrate understanding of the concept of spatial position non-verbally and ability to identify accurately spatial position using prepositions representing the concept. Subjects score higher when demonstrating spatial position non-verbally. The possibility that oral stimuli provided in these test sections acted as verbal mediators in promoting understanding is suggested.

(4) Understanding of the concept of spatial position non-verbally appears to develop earlier than ability to use orally with accuracy the prepositions of spatial position.

(5) Children can be expected to have greater difficulty in understanding the concept of spatial position in printed form than in oral context. The task in understanding the concept in oral context requires recognition of oral word symbols and keeping in mind the concepts represented. In reading, decoding of these word symbols duplicates the task at a more abstract level.

(6) As children gain further experience, less difference can be expected between understanding of the concept of spatial position in oral context and in printed form if

conditions are favorable to learning. There was evidence of less difference between these two forms of concept expression in grade two subjects than in pupils in grade one. In addition, older children with more experience in both language and non-verbal situations reflect better understanding of the concept of spatial position than do younger children.

(7) Ability to understand prepositions of spatial position does not appear to be influenced by sex differences. Boys and girls performed about equally well on all portions of the Spatial Prepositions Test.

(8) Socio-economic status by itself does not appear to influence significantly ability to grasp prepositions of spatial position. According to much of the literature reported (Bernstein, 1967; Hess and Shipman, 1965; Jensen, 1967), high socio-economic status has a positive significant effect on tasks involving verbal stimuli, but this was not borne out in the present study.

(9) Intelligence is a good predictor of success in demonstrating comprehension of spatial position. This corresponds to research evidence cited by Sigel (1964) and others, that higher I.Q. children attain concepts more readily and efficiently than less bright children.

(10) Ability to perform better on the language portion of an intelligence test is more related to the understanding of spatial prepositions than ability in the non-language

test aspects. A similar conclusion has been stated by several researchers (Sigel, 1964; Werner and Kaplan, 1950; Mukerji, 1968), that language is the key determinant in the developmental sequence of concept attainment and thought.

(11) Competent readers in grades one and two can be expected to have a better grasp of the concept of spatial position than less able readers, as good readers are able to make meaningful associations between the abstract word symbols and the concepts they represent. This conclusion is in agreement with findings obtained in research conducted by Burks and Bruce (1955), Kress (1956), and Chase (1969), that proficiency in reading was related to ability to interpret an abstract level.

(12) Some children can be expected to develop and express understanding of the concept of spatial position faster than others. Evidences of individual differences were noted throughout the study, in range of scores in each grade, in specific prepositions understood, and in ability to express understanding.

(13) Children can be expected to have more difficulty in understanding some prepositions of spatial position than others.

IMPLICATIONS FOR READING

The findings of this study suggest a number of implications for the teaching of reading.

(1) As understanding of the concept of spatial position appears to be developmental, it is important that teachers of young children, in planning curriculum and instruction, be fully aware of the pattern of development children can display in the acquisition of this concept.

(2) Teachers should not not assume that understanding in one mode of expression of the concept of spatial position assures understanding when the concept is encountered in another mode. If not assumed, development of the concept can begin where the child has understanding.

(3) If there are differences in the understanding of spatial prepositions when different stimulus-response modes are employed, teachers should use a variety of modes in developing this concept in young children.

(4) As prepositions denoting spatial position occur in the very early stages of the reading program, teachers should plan instruction that will emphasize word meaning of these terms together with perceptual skills.

(5) In working with pupil groups, teachers must expect a wide range of grasp of the concept of spatial position and plan differentiated instruction accordingly. Bright children will not need as many examples and illustrations as other children.

(6) As it was indicated that children who tended to give partial answers often revealed lack of understanding of the underlying concept, teachers must check whether a grasp of the concept of spatial position exists. A one-word answer or even a phrase may be a clue that the child is using 'meaningless' words.

(7) Realizing that certain prepositions are more difficult than others, teachers should examine early books and readers used by children for difficult prepositions and incorporate more concept building into the reading program for these prepositions.

(8) Recognizing that many children make use of verbal mediation to assist their memory and thinking, teachers of young children should understand that this is an essential part of the child's thought process in problem solving and should not discourage it.

(9) If as children read, they develop these concepts of spatial position, teachers should capitalize on this and include concept building as an integral part of the regular reading program.

SUGGESTIONS FOR FURTHER RESEARCH

Arising out of the findings of this study, suggestions for further research in this area are as follows:

(1) Some developmental trends were indicated in the present

study. A longitudinal study initiated at the kindergarten level and continued through the primary grades with the same children might reveal further developmental trends and substantiate indications that the ability to understand prepositions of spatial position is developmental.

(2) A similar investigation with test sample stratified according to intelligence quotients of subjects might prove fruitful in obtaining information as to the precise relationship between intelligence and performance for grade two subjects separately and when compared with performance across the grades.

(3) A further study involving greater differences between higher and lower socio-economic status of subjects would provide more information about this factor.

(4) A research study which focused more on reading aspects and included both reading - verbal and reading non-verbal stimulus-response situations might be undertaken to investigate the understanding of the concept of spatial position in reading.

(5) The design of this study did not require subjects to explain the meaning of each preposition. Investigation of this aspect of development in young children is a further possibility for research.

(6) Research to discover whether difficult prepositions at each grade level can be taught would provide useful information for educators. A test sample including a

control group, and an experimental group receiving instruction over a period of time might be used. Testing at the termination of the study would yield some evidence as to whether teaching of the concept of spatial position is possible.

(7) As inadequacies in performance were evident at the grade two level, similar research is needed which would include grade three as well as the grade levels investigated in the present study.

CONCLUDING STATEMENT

The purpose of this research was to examine the ability of children in kindergarten, grades ones and two to understand the concept of spatial position represented by prepositions. The study also attempted to determine whether acquisition of this concept was developmental as indicated by a significant increase in performance at each successive grade level.

The findings of the study indicated that there was an increase in the ability of subjects at each grade level to demonstrate understanding of spatial position. The gradual increase of mean scores at successive grade levels achieved significance from kindergarten to grade two which lends support to the postulation that the attainment of the concept of spatial relationships is a developmental process. Indications from evidence produced in the study are that young children

have a better understanding of prepositions in non-verbal situations than in speech.

It is hoped that this study has provided primary educators with information which will assist them in planning reading and language curricula with respect to the concept of spatial position.

BIBLIOGRAPHY

A. BOOKS

Anderson, Irving H. and Walter F. Dearborn, The Psychology of Teaching Reading, New York: The Ronald Press Company, 1952.

Bates, Frank L., Factors Related to Understanding of Social Studies Concepts, Unpublished doctor's dissertation, Berkeley: University of California, 1947, cited by David H. Russell, Children Learn to Read, Boston: Ginn and Company, 1949, p. 191.

Bernstein, Basil, "A Socio-Linguistic Approach to Social Learning", in Julius Gould (Ed.), Penguin Survey of Social Sciences, Baltimore: Penguin Books, 1965, pp. 144-168.

_____, "Social Structure, Language and Learning", in John P. DeCecceo (Ed.), The Psychology of Language, Thought and Instruction, New York: Holt, Rinehart and Winston, Inc., 1967, pp. 87-102.

Blishen, B.R., "A Socio-Economic Index for Occupations", in Blishen et al. (Eds.), Canadian Society, 3rd ed., Toronto: Macmillan Company Ltd., 1968, pp. 745-750.

Bond, Guy and Bond, Eva, Teaching the Child to Read, New York: The Macmillan Company, 1943.

Buckingham, Burdette, Ross and E.W. Dolch, A Combined Word List, Boston: Ginn and Company, 1936.

Cantor, Alma, A Historical, Philosophical and Scientific Study of Kindergarten Excursions as a Basis for Social Adaptation and Reading Readiness, Master's Thesis, Cincinnati, Ohio: Teachers College, University of Cincinnati, 1935, cited by Nila B. Smith, Reading Instruction for Today's Children, N.J.: Prentice-Hall, Inc., 1963, p. 291.

Feofanov, M.P., "On the Use of Prepositions in Child Speech", in F. Smith and G. Miller (Eds.), The Genesis of Language: A Psycholinguistic Approach, Cambridge, Mass.: The M.I.T. Press, 1966, pp. 366-367.

Ferguson, George A., Statistical Analysis in Psychology and Education, 2nd ed., Toronto: McGraw-Hill Book Company, 1959.

Flavell, J.H., The Developmental Psychology of Jean Piaget, New York: Van Nostrand, 1963.

Freeman, F.N., Psychology of the Common Branches, Boston: Houghton Mifflin Co., 1916.

Frostig, Marion, Beginning Pictures and Patterns, Chicago: Follett Publishing Company, 1966, pp. 9-10.

Harlow, H.F., "Learning Set and Error Factor Theory", in S. Koch (Ed.), Psychology: A Study of a Science, New York: McGraw-Hill Company, Vol. 9, 1959.

Head, Sir Henry, Aphasia and Kindred Disorders of Speech, Cambridge University Press, 1926.

Hunt, J. McV., Intelligence and Experience, New York: Ronald Press Company, 1961.

Jensen, Arthur R., "Social Class and Verbal Learning", in John P. DeCecco (Ed.), The Psychology of Language, Thought and Instruction, New York: Holt, Rinehart and Winston, Inc., 1967, pp. 103-116.

Jesperson, Otto, Language: Its Nature, Development and Origin, London: George Allen and Unwin, Limited, 1921.

Kress, Roy A., Jr., "An Investigation of the Relationship Between Concept Formation and Achievement in Reading", Temple University, 1955, Dissertation Abstracts, Vol. 16, March, 1956, pp. 573-574, cited by Henry P. Smith and Emerald V. Dechant, Psychology in Teaching Reading, Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1961, p. 38.

Loban, W., The Language of Elementary School Children, Champaign, Illinois: National Council of Teachers of English, Research Report No. 1, 1963.

Lorge, Irving and Edward L. Thorndike, The Teacher's Word Book of 30,000 Words, New York: Bureau of Publications, Teachers College, Columbia University.

Liublinskaya, A.A., "The Development of Children's Speech and Thought", in Brian Simon (Ed.), Psychology in the Soviet Union, London: Routledge and Kegan Paul Ltd., 1957.

McCarthy, D.A., The Language Development of the Preschool Child, Minneapolis: University of Minnesota Press, 1930.

Menyuk, Paula, Sentences Children Use, Research Monographs No. 52, Cambridge, Mass.: The M.I.T. Press, 1969.

Mukerji, Rose, "Roots in Early Childhood for Continuous Learning", in Joe E. Frost (Ed.), Early Childhood Education Rediscovered, Toronto: Holt, Rinehart and Winston, Inc., 1968, pp. 27-36.

Piaget, Jean and Inholder B., The Child's Conception of Space, London: Routledge and Kagan Paul, 1956.

Piaget, Jean, The Construction of Reality in the Child, New York: Basic Books, 1954.

_____, The Language and Thought of the Child, (Rev. Ed.), London: Routledge and Kagan Paul Ltd., 1959.

Russell, David H., Children's Thinking, Ginn and Company, 1956.

Smith, Henry P. and Emerald V. Dechant, Psychology in Teaching Reading, Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1961.

Smith, Nila B., Reading Instruction for Today's Children, Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1963.

Sohkin, F.A., "On the Formation of Linguistic Generalizations in the Course of Speech Development", in G. Miller and F. Smith (Eds.), The Genesis of Language, Cambridge, Mass.: Massachusetts Institute of Technology Press, 1966, pp. 382-383.

Spache, George, Good Reading for Poor Readers, Rev. Ed., Champaign, Illinois: Garrard Publishing Company, 1964.

Stanley, Julian C., "California Test of Mental Maturity Short-Form", in Oscar Kriser Buros (Ed.), The Sixth Mental Measurements Yearbook, New Jersey: The Gryphon Press, 1965.

Templin, Mildred, Certain Language Skills in Children, Minneapolis: University of Minnesota Press, 1957.

Underwood, Benton, J., "Some Relationships Between Concept Learning and Verbal Learning", in J. Klausmier and H. Harris (Eds.), Analysis of Concept Learning, New York: Academic Press, 1966, pp. 51-64.

Vinacke, W. Edgar, The Psychology of Thinking, New York: McGraw-Hill Book Company, Inc., 1952.

Vygotsky, L.S., Thought and Language, Cambridge, Mass.: M.I.T. Press, 1962.

Watts, A.F., The Language and Mental Development of Children, London: George G. Harrap and Co., Ltd., 1944.

B. PERIODICALS

Amster, Harriet, "Concept Formation in Children", Elementary English, Vol. 42, 1965, pp. 543-552.

Ames, Louis Bates and James Learned, "The Development of Verbalized Space in the Young Child", Journal of Genetic Psychology, Vol. 72, 1948, pp. 63-84.

Annett, Marian, "The Classification of Instances of Four Common Class Concepts by Children and Adults", British Journal of Educational Psychology, 1959, Vol. 29, pp. 223-236.

Ausubel, David P., "A Teaching Strategy for Culturally Deprived Pupils: Cognitive and Motivational Considerations", School Review, Vol. 71, 1967, pp. 454-463.

_____, "The Use of Advance Organizers in the Learning and Retention of Meaningful Verbal Material", Journal of Educational Psychology, Vol. 51, 1960, pp. 267-272.

Bedwell, Margaret, Comprehension of Concepts of Quantity in Third Grade Social Studies Reading Material, Unpublished Master's Thesis, University of Iowa, 1932, cited by Mary C. Serra, "How to Develop Concepts and their Verbal Representations", Elementary School Journal, January, 1953, pp. 275-285.

Braun, Jean S., "An Investigation of the Relationship Between Concept Formation Ability and Reading Achievement at Three Developmental Levels", Unpublished Ph.D. Dissertation, Department of Psychology, Wayne State University, 1961, cited by John H. Langer, "Vocabulary and Concept Development", Journal of Reading, April, 1967, pp. 448-456.

Brown, R. and Ursula Bellugi, "Three Processes in the Child's Acquisition of Syntax", Harvard Educational Review, Vol. 34, 1964, pp. 43-79.

Burks, Harold F. and Paul Bruce, "The Characteristics of Poor and Good Readers as Disclosed by the Wechsler Intelligence Scale for Children", Journal of Educational Psychology, Vol. 46, December, 1955, pp. 488-493.

Carroll, John B., "Words, Meanings and Concepts", Harvard Educational Review, 1964, 34:2, pp. 178-202.

Chase, C.I., "Concept Formation as a Basis for Measuring Developmental Reading", Elementary School Journal, Vol. 69, 1969, pp. 210-214.

Davis, Irene Poole, "The Speech Aspects of Reading Readiness", National Elementary School Principal, 17th Yearbook, 1938, pp. 282-289.

Deutsche, Jean M., "The Development of Children's Concepts of Causal Relations", University of Minnesota Institute of Child Welfare Monographs, No. 13, 1937.

Dolch, E.W. and Don Leeds, "Vocabulary Tests and Depth of Meaning", Journal of Educational Research, 47, 1953, pp. 181-189.

Dunkel, Harold B., "Testing the Precise Use of Words", College English, Vol. 47, 1944, pp. 181-189.

Estes, P.S., "Developmental Psychology", in P.R. Farnsworth and Q. McNemer (Eds.), Annual Review of Psychology, Palto Alto: California Annual Review, Inc., Vol. 7, 1956.

Feifel, H. and Irving Lorge, "Qualitative Differences in the Vocabulary Responses of Children", Journal of Educational Psychology, Vol. 61, 1950, pp. 1-19.

Fennema, Elizabeth H., "Mental Imagery and the Reading Process", Elementary School Journal, Vol. 59, February, 1959, pp. 286-289.

Gammon, Agnes L., "Comprehension of Words and Multiple Meanings", California Journal of Educational Research, Vol. III, November, 1952, pp. 228-232.

Grigsby, Olive J., "An Experimental Study of the Development of Concepts of Relationship in Pre-School Children as Evidenced by their Expressive Ability", Journal of Experimental Education, Vol. I, 1932, pp. 144-162.

Hall, G. Stanley, "The Content of Children's Minds on Entering School", Pedagogical Seminary, Vol. I, 1891, pp. 139-173.

Herbers, Sister M.B., "Comprehension Difficulties in a Third Grade Reader", Elementary English Review, Vol. 16, February, 1939, pp. 53-57.

Hess, R.D. and V.C. Shipman, "Early Experience and the Socialization of Cognitive Modes in Children", Child Development, Vol. 36, 1965, pp. 869-886.

Holmes, Jack A., "The Brain and the Reading Process", in Reading is Creative Living, Twenty-second Yearbook of the Claremont Reading Conference, Claremont: California Curriculum Laboratory, 1957, pp. 49-67.

Kagan, J., Moss, H. and Sigel, I., "The Psychology of Significance of Styles of Conceptualization", in J. Wright and J. Kagan (Eds.), Basic Cognitive Processes in Children, Monographs of Society of Research in Child Development, 1963, pp. 97-116.

La Brant, Lou, "A Genetic Approach to Language", Fourteenth Yearbook of Clarement College Reading Conference, 1949, pp. 5-29.

Lacey, Joy M., Social Studies Concepts of Children in the First Three Grades, Contributions to Education, No. 548, Bureau of Publications, Teachers College, Columbia University, 1932.

Luria, A.R., "The Direct Function of Speech", Word, 15, 1959, pp. 341-352.

McCullough, Constance M., "Learning to Use Content Clues", Elementary English Review XX, April, 1943, pp. 140-143.

Meyer, E., "Comprehension of Spatial Relations In Preschool Children", Journal of Genetic Psychology, Vol. 57, 1940, pp. 119-151.

Miller, N.E., "The Perception of Children: A Genetic Study Employing the Critical Choice Delayed Action", Journal of Genetic Psychology, Vol. 44, 1934, pp. 321-339.

O'Donnell, Griffin and Morris, Syntax of Kindergarten and Elementary School Children, Champaign, Illinois: National Council of Teachers of English, 1967.

Olsen, J., "The Verbal Ability of the Culturally Different", The Reading Teacher, April, 1965, pp. 552-556.

Osborn, W.J., Mirriel Huntington and Viola Meeks, "The Language of Relativity as Related to Reading Readiness", Journal of Educational Research, Vol. 39, 1946, pp. 583-601.

Reichard, Suzanne, Marion Schneider and David Rappaport, "The Development of Concept Formation in Children", American Journal of Orthopsychiatry, Vol. 14, 1944, pp. 156-161.

Russell, David H., The Dimensions of Children's Meaning Vocabularies in Grades Four Through Twelve, Berkeley: University of California Press, 1954.

Sachs, H.J., "The Reading Method of Acquiring Vocabulary", Journal of Educational Research, Vol. 36, February, 1943, pp. 457-464.

Sears, P.S., "Developmental Psychology", in P.R. Farnsworth and Q. McNemer (Eds.), Annual Review of Psychology, Palto Alto: California Annual Review Inc., Vol. 7, 1959.

Serra, Mary C., "How to Develop Concepts and their Verbal Representations", The Elementary School Journal, Vol. 53, January, 1953, pp. 275-285.

Sigel, Irving, "The Attainment of Concepts", in Hoffman and Hoffman (Eds.), Review of Child Development Research, New York: Russell Sage Foundation, 1964.

_____, "Developmental Trends in the Abstraction Behavior of Children", Child Development, Vol. 24, 1953, pp. 131-144.

Singer, Harry, "An Instructional Strategy for Developing Conceptual Responses in Reading Readiness", in J. Allen Figurel (Ed.), Vistas in Reading, Proceedings Eleventh Annual Convention, Vol. 11, Part ;, International Reading Association, 1967, pp. 425-431.

_____, "Substrata-Factor Theory of Reading: Theoretical Design for Teaching Reading", in J. Allen Figurel (Ed.), International Reading Association Conference Proceedings, New York: Scholastic Magazines, Vol. 7, 1962, pp. 226-232.

Smoke, K.L., "The Experimental Approach to Concept Learning", Psychological Review, Vol. 42, 1935, pp. 274-279.

Sonquist, Hanne D. and Constance K. Kamii, "Applying Some Piagetian Concepts in the Classroom for the Disadvantaged", in Joe E. Frost (Ed.), Early Childhood Education Rediscovered, Toronto: Holt, Rinehart and Winston, Inc., 1968, pp. 169-179.

Stauffer, Russell, G., "Concept Development and Reading", The Reading Teacher, November, 1965, pp. 100-105.

_____, "Reading, Thinking and Concept Attainment", in Paul C. Berg and John E. George (Eds.), Reading and Concept Attainment, Highlights of the 1967 Pre-Convention Institutes, Newark: International Reading Association, 1968, pp. 34-53.

Welch, L. and L. Long, "The Higher Structural Phases of Concept Formation in Children", Journal of Psychology, Vol. 9, 1940a, pp. 59-95.

Werner H. and E. Kaplan, "The Acquisition of Word Meaning Through Verbal Context: An Experimental Study", Journal of Psychology, 1950, Vol. 29, pp. 251-257.

Worley, Stinson E. and William E. Story, "Socioeconomic Status and Language Facility of Beginning First Graders", The Reading Teacher, February, 1967, pp. 400-403.

C. THESES

Clarke, Lois K., "The Effect of Comprehension of Simplification of Social Studies Reading Material in a Second Grade", Master's Thesis, University of Iowa, 1933, in Richard G. Lidberg, Reading Comprehension Difficulties in Fourth, Fifth and Sixth Grade Social Studies Textbooks, University of Iowa, 1965.

McLeod, Edna M., Understanding of Spatial Prepositions, Unpublished Master's Thesis, University of Alberta, 1969.

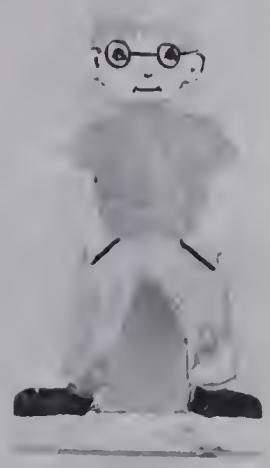
Rawson, Hildred I., The Relationship of Cognition, Language and Reading, Ph.D. Thesis, University of Alberta, 1969.

APPENDIX A

EXAMPLES OF SELECTED OBJECTS USED

IN SPATIAL PREPOSITIONS TEST







SCHOOL







Models Used in Spatial Prepositions Test

Models Pictured

postman boy girl sign

bicycle cap school bag

Not Photographed

tree sprinkler see-saw









Toy Representations Used in Spatial Prepositions Test

Toy Representations Pictured

bird airplane ball

bus car dog

Not Photographed

hoop



Ball, Box and Hoop Used in Section Two of

Spatial Prepositions Test

Photograph was taken after testing 120 children

APPENDIX B

SPATIAL PREPOSITIONS TEST

DATA COLLECTION BOOKLET

NAME: _____ SCHOOL: _____

I.D. _____ SEX _____ GRADE _____

I.Q. _____ BIRTHDAY _____ C.A. _____ (months)

OCCUPATION(S) _____ S.E.S.R. _____

_____

Subtest Section 1

Verbal (Oral) — Non-Verbal Stimulus-Response

A sentence is given orally by the examiner and the object to be manipulated is placed in front of the child. The child places the object in the position stated in the sentence. Full credit is given only of the spatial position is correctly indicated.

Sample Sentence

The bicycle is by the gate.

1. The bicycle is inside the yard.

2. The boy runs around the tree.

3. A car is on the right of the school.

4. The girl is outside the school yard.

5. The sprinkler is behind the school.

6. The ball is below the see-saw.

7. The bird goes over the tree.

8. The sign is above the door.

9. A bicycle is between the school and the fence.

10. The bird is on top of the tree.

11. The ball goes through the fence.

12. The dog is underneath the tree.

13. The hoop is beside the school.

14. The boy is on the bicycle.

15. The sprinkler is out of the school yard.

16. The girls are near the see-saw.

17. The ball is beneath the fence.

18. The see-saw is on the left of the school.

19. The car is across the street.

20. The boys walk in front of the school.

Subtest Section 2

Verbal (Oral) — Verbal (Oral) Stimulus-Response

Examiner demonstrates a spatial position using a ball or a hoop and the child is asked to describe the spatial position shown. Full credit is given only if the correct preposition is used by the child in his response.

Sample Sentence

Ball is placed on the table.

INVESTIGATOR: Can you tell me where the ball is?

1. Above the child's head.

2. Below the table.

3. In front of the child.

4. Behind the child.

5. Inside the box.

6. Around the box.

7. Underneath the box lid.

8. Beside the box.

9. Over the hoop.

10. Through the hoop.

11. On the right side of the table.

12. Between the box and the hoop.

13. Out of the box.

14. Near the box.

15. Across the hoop.

16. On the left of the box.

17. <u>On</u> the hoop.

18. <u>On top of</u> the box.

19. <u>Outside</u> of the hoop.

20. <u>Beneath</u> the box.

Subtest Section 3

Reading — Non-Verbal

A sentence is read orally by the child after which he is given the object to place in the position indicated in the sentence. Full credit is given only if the object is placed in the correct spatial position.

Sample Sentence

Jack is playing behind Susan.

1. The postman came out of the school.

2. Jack is riding his bicycle in front of Tom.

3. Trees are on the right of the school

4. The ball rolled outside the school yard.

5. The airplane went over the school.

6. Two cars are near the school.

7. A sprinkler is beside the school.

8. A car went through the gate.

9. The bus stopped across the street.

10. Billy's dog ran around the see-saw.

11. Susan put her school bag below the see-saw.

12. The ball went on top of the school.

13. Children are playing behind the school.

14. Tom went underneath the fence to get the ball.

15. Betty and Susan ride on the see-saw.

16. Betty is above Susan on the see-saw.

17. The children go inside the school.

18. Boys play football on the left of the school.

19. Betty is jumping rope between two girls.

20. Jack found a cap beneath the tree.

APPENDIX C

SAMPLES OF SUBJECTS" RESPONSES

ON VERBAL (ORAL) — VERBAL (ORAL)

STIMULUS-RESPONSE SECTION

FEMALE, KINDERGARTEN, LSES, I.Q. 93

VERBAL (ORAL) — VERBAL (ORAL) STIMULUS-RESPONSE

1. Ball is held <u>above</u> the child's head.

INVESTIGATOR: Where is the ball?

RESPONSE: UP.

INVESTIGATOR: Up? Up where?

RESPONSE: UP IN THE AIR.

2. Ball is held <u>below</u> the table.

INVESTIGATOR: Where is the ball now?

RESPONSE: UNDER THE TABLE.

3. Ball is held <u>in front of</u> the child.

INVESTIGATOR: Where am I holding the ball now?

RESPONSE: IN FRONT OF ME.

4. Ball is held <u>behind</u> the child.

INVESTIGATOR: Can you tell where the ball is?

RESPONSE: IN BACK OF ME.

5. Ball is placed inside the box.

INVESTIGATOR: Where have I put the ball now?

RESPONSE: IN THE BOX.

6. Hoop is placed <u>around</u> the box.

INVESTIGATOR: Where is the hoop?

RESPONSE: ON THE MIDDLE OF THE BOX.

7. Ball is held underneath the lid of the box.

INVESTIGATOR: Where is the ball?

RESPONSE: IN THE BOX.

8. Ball is placed beside the box.

INVESTIGATOR: Where is the ball now?

RESPONSE: BESIDE THE BOX.

9. Hoop is held in a vertical position and the ball is moved over the hoop.

INVESTIGATOR: Where did the ball go?

RESPONSE: OVER THE HOOP.

10. Ball is passed through the hoop.

INVESTIGATOR: Where did the ball go this time?

RESPONSE: IN THE HOOP.

11. Hoop is placed on the right side of the table.

INVESTIGATOR: On what side of the table is the hoop?

RESPONSE: ON THE TABLE.

INVESTIGATOR: What part of the table?

RESPONSE: BESIDE THE TABLE.

12. Ball is placed midway between the box and the hoop.

INVESTIGATOR: Where is the ball?

RESPONSE: IN THE MIDDLE.

INVESTIGATOR: In the middle? Where?

RESPONSE: IN THE MIDDLE OF THE TABLE.

13. Ball is brought out of the box.

INVESTIGATOR: Where did the ball go?

RESPONSE: OUT OF THE BOX.

14. Ball is put near the box.

INVESTIGATOR: Where is the ball now?

RESPONSE: BESIDE THE BOX.

15. Hoop is placed flat on the table and ball is moved across the hoop.

INVESTIGATOR: Where did the ball go?

RESPONSE: TO THAT SIDE TO THAT SIDE.

INVESTIGATOR: Can you tell me without pointing?

RESPONSE: OVER THERE TO THERE.

16. Ball is placed on the left side of the box.

INVESTIGATOR: Where is the ball?

RESPONSE: BESIDE THE EDGE.

INVESTIGATOR: Beside the edge? Where?

RESPONSE: WHERE THE CHAIR IS.

17. Ball is held in position on the hoop.

INVESTIGATOR: Where is the ball now?

RESPONSE: ON THE TOP OF THE HOOP.

18. Ball is put on top of the box.

INVESTIGATOR: Can you tell where the ball is?

RESPONSE: ON TOP OF THE BOX.

19. Hoop is placed flat on the table and ball is moved from inside the hoop to the outside of the hoop.

INVESTIGATOR: Where did the ball go?

RESPONSE: OUT OF THE HOOP.

20. Hoop is placed beneath the box.

INVESTIGATOR: Where is the hoop?

RESPONSE: UNDER THE BOX.

FEMALE, GRADE ONE, LSES, I.Q. 98

VERBAL (ORAL) — VERBAL (ORAL) STIMULUS-RESPONSE

1. Ball is held <u>above</u> the child's head.

INVESTIGATOR: Where is the ball?

RESPONSE: TO THE RIGHT.

INVESTIGATOR: To the right? Where?

RESPONSE: RIGHT THERE.

INVESTIGATOR: Can you think of other words to tell me?

RESPONSE: NO.

2. Ball is held <u>below</u> the table.

INVESTIGATOR: Where is the ball now?

REPONSE: UNDER THE TABLE.

3. Ball is held <u>in front of</u> the child.

INVESTIGATOR: Where am I holding the ball now?

RESPONSE: IT'S POINTING TO THE TABLE.

INVESTIGATOR: On what side of you is it?

RESPONSE: LEFT.

4. Ball is held <u>behind</u> the child.

INVESTIGATOR: Can you tell where the ball is?

RESPONSE: I DON'T KNOW WHERE.

5. Ball is placed <u>inside</u> the box.

INVESTIGATOR: Where have I put the ball now?

RESPONSE: IT'S IN THE BOX.

6. Hoop is placed around the box.

INVESTIGATOR: Where is the hoop?

RESPONSE: IT'S ON TOP OF THE BOX ... OVER THE BOX.

7. Ball is held underneath the lid of the box.

INVESTIGATOR: Where is the hoop?

RESPONSE: ON TOP OF THE ... BOX OF THE LID.

8. Ball is placed beside the box.

INVESTIGATOR: Where is the ball now?

RESPONSE: IT'S AGAINST THE BOX.

9. Hoop is held in a vertical position and the ball is moved over the hoop.

INVESTIGATOR: Where did the ball go?

RESPONSE: IT WENT OVER THE HOOP.

10. Ball is passed through the hoop.

INVESTIGATOR: Where did the ball go this time?

RESPONSE: IT WENT THROUGH THE HOOP.

11. Hoop is placed on the right side of the table.

INVESTIGATOR: On what side of the table is the hoop?

RESPONSE: RIGHT.

12. Ball is placed midway between the box and the hoop.

INVESTIGATOR: Where is the ball?

RESPONSE: IN BETWEEN THE BOX.

INVESTIGATOR: In between the box? Where?

RESPONSE: NO RESPONSE.

13. Ball is brought <u>out</u> of the box.

INVESTIGATOR: Where did the ball go?

RESPONSE: YOU OPENED THE BOX AND TOOK IT OUT.

14. Ball is put <u>near</u> the box.

INVESTIGATOR: Where is the ball now?

RESPONSE: IT'S ALMOST AGAINST THE BOX.

15. Hoop is placed flat on the table and ball is moved <u>across</u> the hoop.

INVESTIGATOR: Where did the ball go?

RESPONSE: TO THE OTHER SIDE.

INVESTIGATOR: To the other side? Where?

RESPONSE: OF THE HOOP.

16. Ball is placed <u>on the left</u> side of the box.

INVESTIGATOR: Where is the ball?

RESPONSE: LEFT.

INVESTIGATOR: Left? Where?

RESPONSE: NO RESPONSE.

17. Ball is held in position <u>on</u> the hoop.

INVESTIGATOR: Where is the ball now?

RESPONSE: ON TOP OF THE HOOP.

18. Ball is put <u>on top of</u> the box.

INVESTIGATOR: Can you tell where the ball is?

RESPONSE: ON TOP OF THE BOX.

19. Hoop is placed flat on the table and ball is moved from inside the hoop to the outside of the hoop.

INVESTIGATOR: Where did the ball go?

RESPONSE: ON THE TABLE.

INVESTIGATOR: I'll show you that one again. (Demonstration is repeated.) Where did the ball go?

RESPONSE: ON THE TABLE.

20. Hoop is placed beneath the box.

INVESTIGATOR: Where is the hoop?

RESPONSE: I DON'T KNOW.

INVESTIGATOR: I'll show you once again. (Demonstration is repeated.) Where is the hoop?

RESPONSE: THE BOX IS ON TOP OF IT.

FEMALE, GRADE TWO, LSES, I.Q. 98

VERBAL (ORAL) — VERBAL (ORAL) STIMULUS-RESPONSE

1. Ball is held above the child's head.

INVESTIGATOR: Where is the ball?

RESPONSE: UP IN THE AIR.

2. Ball is held below the table.

INVESTIGATOR: Where is the ball now?

RESPONSE: UNDER THE TABLE.

3. Ball is held in front of the child.

INVESTIGATOR: Where am I holding the ball now?

RESPONSE: NO RESPONSE.

INVESTIGATOR: Can you tell me where it is now?

RESPONSE: NO.

4. Ball is held behind the child.

INVESTIGATOR: Can you tell where the ball is?

RESPONSE: BEHIND MY BACK.

5. Ball is placed inside the box.

INVESTIGATOR: Where have I put the ball now?

RESPONSE: IN THE BOX.

6. Hoop is placed around the box.

INVESTIGATOR: Where is the hoop?

RESPONSE: ON TOP OF THE BOX.

7. Ball is held underneath the lid of the box.

INVESTIGATOR: Where is the hoop?

RESPONSE: TOUCHING THE TOP OF THE BOX.

8. Ball is placed beside the box.

INVESTIGATOR: Where is the ball now?

RESPONSE: ON THE TABLE TOUCHING THE BOX.

INVESTIGATOR: Can you say it in another way?

RESPONSE: NO RESPONSE.

9. Hoop is held in a vertical position and the ball is moved over the hoop.

INVESTIGATOR: Where did the ball go?

RESPONSE: OVER THE HOOP.

10. Ball is passed through the hoop.

INVESTIGATOR: Where did the ball go this time?

RESPONSE: THROUGH THE HOOP.

11. Hoop is placed on the right side of the table.

INVESTIGATOR: On what side of the table is the hoop?

RESPONSE: ON THE TABLE.

INVESTIGATOR: Can you tell us more about it? What part of the table?

RESPONSE: ON TOP OF THE TABLE.

12. Ball is placed midway between the box and the hoop.

INVESTIGATOR: Where is the ball?

RESPONSE: ON THE TABLE BETWEEN THE HOOP AND THE BOX.

13. Ball is brought out of the box.

INVESTIGATOR: Where did the ball go?

RESPONSE: IT COMES OUT OF THE BOX.

14. Ball is put near the box.

INVESTIGATOR: Where is the ball now?

RESPONSE: ON THE TABLE IN FRONT OF THE RED PART OF THE BOX.

15. Hoop is placed flat on the table and ball is moved across the hoop.

INVESTIGATOR: Where did the ball go?

RESPONSE: FROM SIDE TO SIDE ON THE HOOP.

INVESTIGATOR: Can you say that in another way?

RESPONSE: NO.

16. Ball is placed on the left side of the box.

INVESTIGATOR: Where is the ball?

RESPONSE: ON THE TABLE BEHIND THE BOX.

17. Ball is held in position on the hoop.

INVESTIGATOR: Where is the ball now?

RESPONSE: ON THE TABLE ON TOP OF THE HOOP.

18. Ball is put on top of the box.

INVESTIGATOR: Can you tell where the ball is?

RESPONSE: ON THE TABLE ON TOP OF THE BOX.

19. Hoop is placed flat on the table and ball is moved from inside the hoop to the outside of the hoop.

INVESTIGATOR: Where did the ball go?

RESPONSE: ON TOP OF THE TABLE.

INVESTIGATOR: Can you think of another way of telling it?

RESPONSE: IT WAS IN THE HOOP AND YOU TOOK IT AND PUT IT OUT OF THE HOOP.

20. Hoop is placed beneath the box.

INVESTIGATOR: Where is the hoop?

RESPONSE: UNDER THE BOX.

APPENDIX D

SAMPLE OF SCORING

FOR VERBAL (ORAL) — VERBAL (ORAL)

STIMULUS-RESPONSE SECTION

SCORING PROCEDURES FOR VERBAL (ORAL) — VERBAL (ORAL) STIMULUS-RESPONSE

Subjects' responses were recorded on a tape recorder and later transcribed and analyzed. A sample transcript is included in this section together with the scoring procedures used.

Children's responses were scored as either correct, incorrect, partially correct or plausible. To be credited as a correct response, the preposition tested was required in the answer.

MALE, GRADE ONE, HSES, I.Q. 102

VERBAL (ORAL) — VERBAL (ORAL) STIMULUS-RESPONSE

1. Ball is held <u>above</u> the child's head.

INVESTIGATOR: Where is the ball?

RESPONSE: ON MY HEAD. (incorrect)

2. Ball is held <u>below</u> the table.

INVESTIGATOR: Where is the ball now?

RESPONSE: UNDER THE TABLE. (plausible)

3. Ball is held <u>in front of</u> the child.

INVESTIGATOR: Where am I holding the ball now?

RESPONSE: BY MY STOMACH. (plausible)

4. Ball is held <u>behind</u> the child.

INVESTIGATOR: Can you tell where the ball is?

RESPONSE: BY MY BACK. (plausible)

5. Ball is placed <u>inside</u> the box.

INVESTIGATOR: Where have I put the ball now?

RESPONSE: IN THAT BOX. (plausible)

6. Hoop is placed <u>around</u> the box.

INVESTIGATOR: Where is the hoop?

RESPONSE: AROUND THE BOX. (correct)

7. Ball is held <u>underneath</u> the lid of the box.

INVESTIGATOR: Where is the hoop?

RESPONSE: ON THE BOTTOM OF THE TOP OF THE BOX. (plausible)

8. Ball is placed beside the box.

INVESTIGATOR: Where is the ball now?

RESPONSE: BESIDE THE BOX. (correct)

9. Hoop is held in a vertical position and the ball is moved <u>over</u> the hoop.

INVESTIGATOR: Where did the ball go?

RESPONSE: IT WENT UP.

INVESTIGATOR: Up? Where?

RESPONSE: UP IN THE AIR?

INVESTIGATOR: Then what did it do?

RESPONSE: IT WENT DOWN. (incorrect)

10. Ball is passed <u>through</u> the ring.

INVESTIGATOR: Where did the ball go this time?

RESPONSE: THROUGH THE HOOP. (correct)

11. Hoop is placed <u>on the right</u> side of the table.

INVESTIGATOR: On what side of the table is the hoop?

RESPONSE: THE LEFT. (incorrect)

12. Ball is placed midway <u>between</u> the box and the hoop.

INVESTIGATOR: Where is the ball?

RESPONSE: ON THE LEFT OF THE BOX. (incorrect)

13. Ball is brought <u>out</u> of the box.

INVESTIGATOR: Where did the ball go?

RESPONSE. OUT.

INVESTIGATOR: Out? Out where?

RESPONSE: OUT OF THE BOX. (partial credit given)

14. Ball is put <u>near</u> the box.

INVESTIGATOR: Where is the ball now?

RESPONSE: ON THE TABLE.

INVESTIGATOR: On the table? Where?

RESPONSE: BESIDE THE BOX. (incorrect)

15. Hoop is placed flat on the table and ball is moved <u>across</u> the hoop.

INVESTIGATOR: Where did the ball go?

RESPONSE: IT SLID.

INVESTIGATOR: It slid? Where?

RESPONSE: TO THE OTHER SIDE OF THE HOOP. (plausible)

16. Ball is placed <u>on the left</u> side of the box.

INVESTIGATOR: Where is the ball?

RESPONSE: ON THE RIGHT OF THE BOX. (incorrect)

17. Ball is held in position <u>on</u> the hoop.

INVESTIGATOR: Where is the ball now?

RESPONSE: ON THE SIDE OF THE HOOP. (incorrect)

18. Ball is put <u>on top of</u> the box.

INVESTIGATOR: Can you tell where the ball is?

RESPONSE: ON THE TOP OF THE BOX. (correct)

19. Hoop is placed flat on the table and ball is moved from inside the hoop to the <u>outside</u> of the hoop.

INVESTIGATOR: Where did the ball go?

RESPONSE: OUT OF THE HOOP. (plausible)

20. Hoop is placed <u>beneath</u> the box.

INVESTIGATOR: Where is the hoop.

RESPONSE: UNDER THE BOX. (plausible)

APPENDIX E

CALIFORNIA SHORT-FORM TEST OF MENTAL MATURITY

LEVEL 0 AND LEVEL 1

AND

GATES-MACGINITIE READING TESTS

PRIMARY A AND PRIMARY B

1963 S-FORM LEVEL 0

CALIFORNIA SHORT-FORM TEST OF MENTAL MATURITY

DEVISED BY ELIZABETH T. SULLIVAN, WILLIS W. CLARK, AND ERNEST W. TIEGS

TO THE TEACHER:

Before permitting the children to open their booklets, see that each child's name, age, school, and other information are filled in on the back cover. Encourage the children to do as many items in the test as they can.

PUBLISHED BY CALIFORNIA TEST BUREAU, A DIVISION OF McGRAW-HILL BOOK COMPANY, DEL MONTE RESEARCH PARK, MONTEREY, CALIFORNIA
COPYRIGHT © 1963 BY McGRAW-HILL, INC. ALL RIGHTS RESERVED — PRINTED IN THE UNITED STATES OF AMERICA — THIS WORK, OR ANY PARTS THEREOF, MAY NOT BE REPRODUCED IN ANY FORM WITHOUT PERMISSION OF THE PUBLISHERS

14TH PRINTING

TEST 1

1






2






3





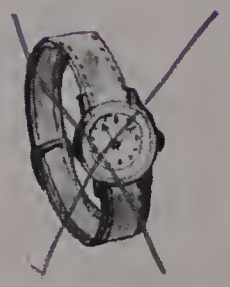
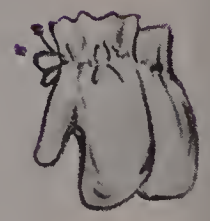

4





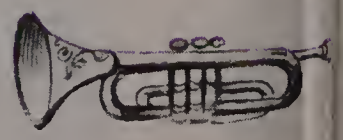

5



6



7






TEST 1 SCORE
(number right) . . .

TEST 2

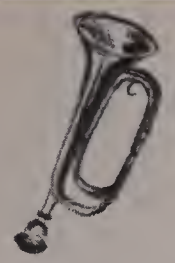
1







2



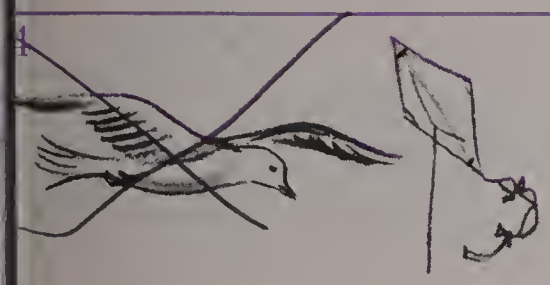

3

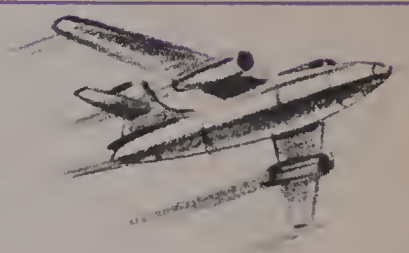




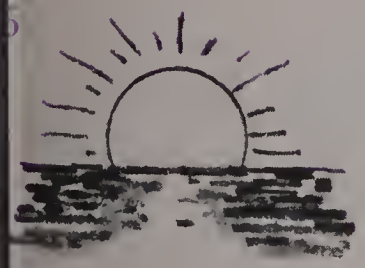


4



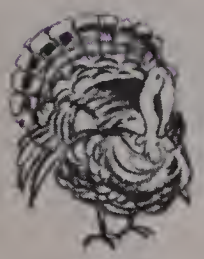
5





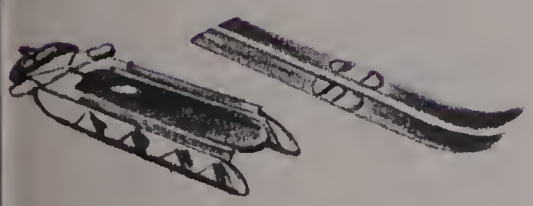
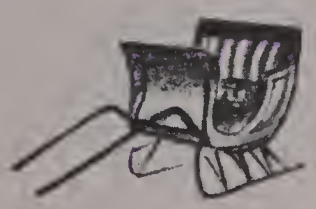
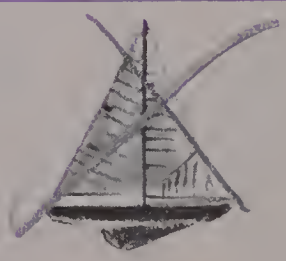


6



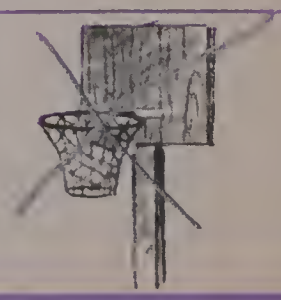

7


8







TEST 2 SCORE
(number right) . . .

TEST 3

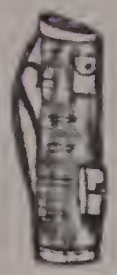
1

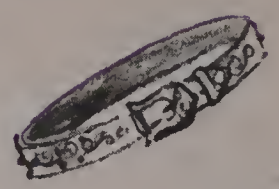
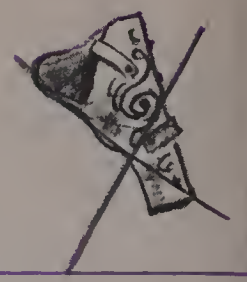







2

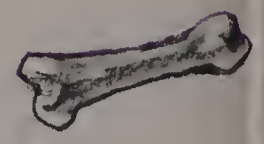



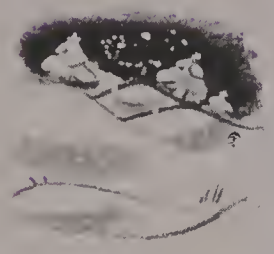
3

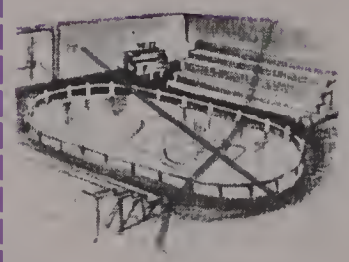


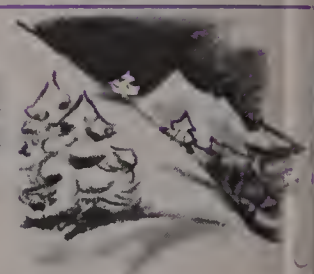


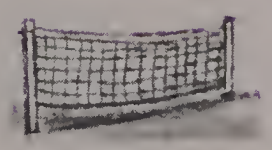
4





5

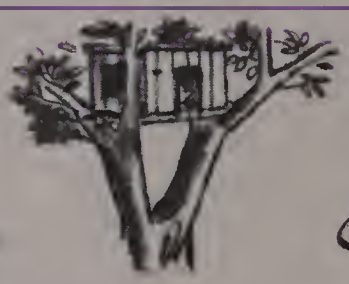




6








7






8

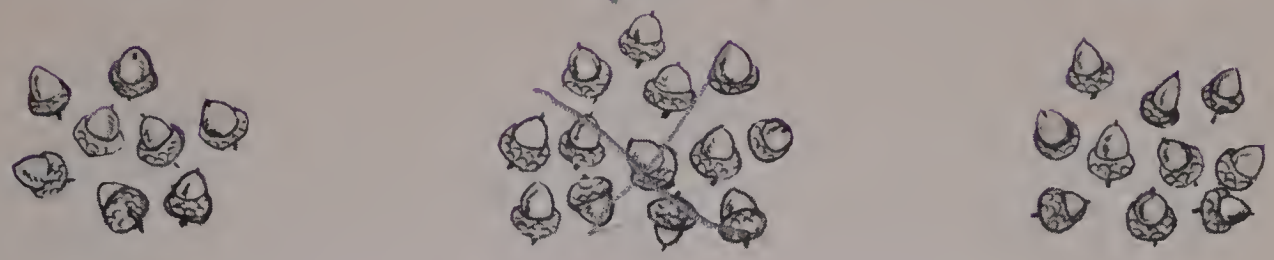
TEST 3 SCORE
(number right) . . .

TEST 4

1



2



3



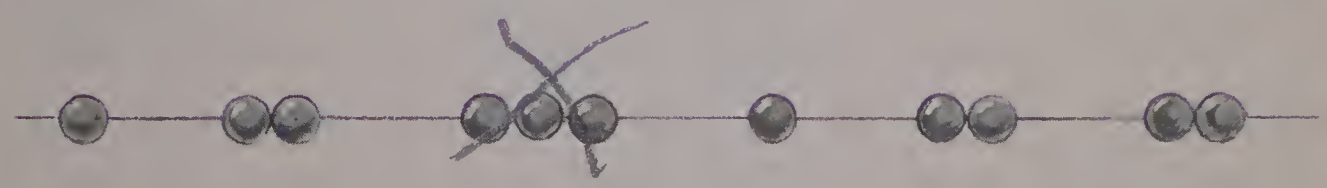
4



5



6



7



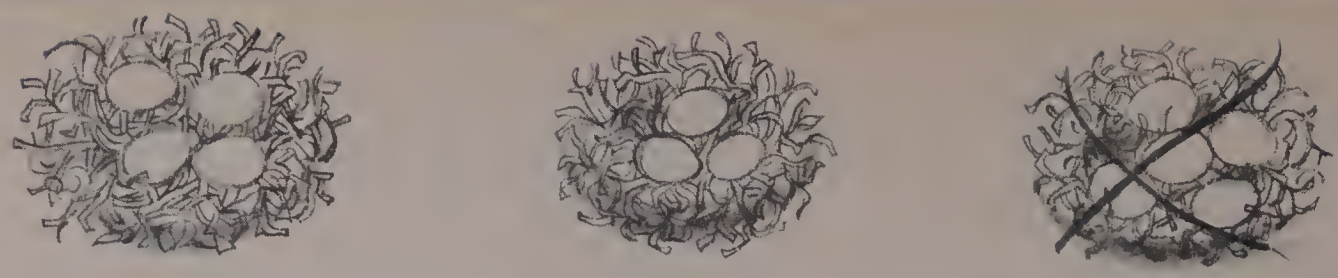
8



TEST 4 SCORE
(number right) . . .

TEST 5

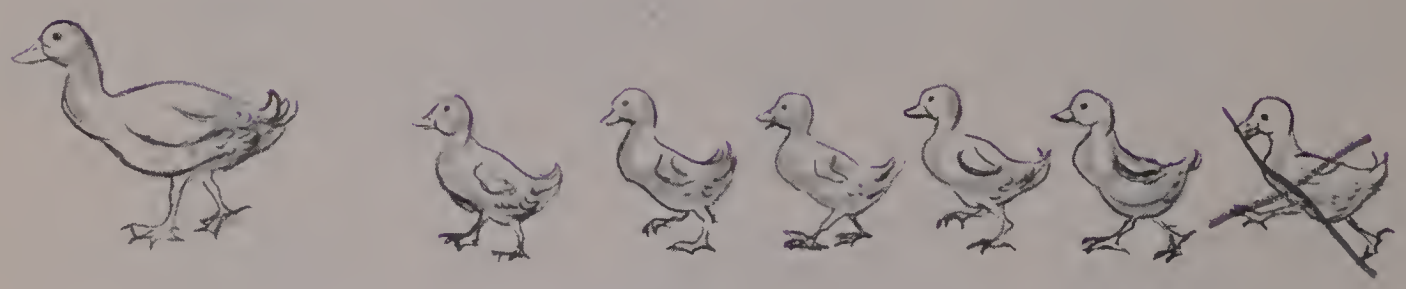
1



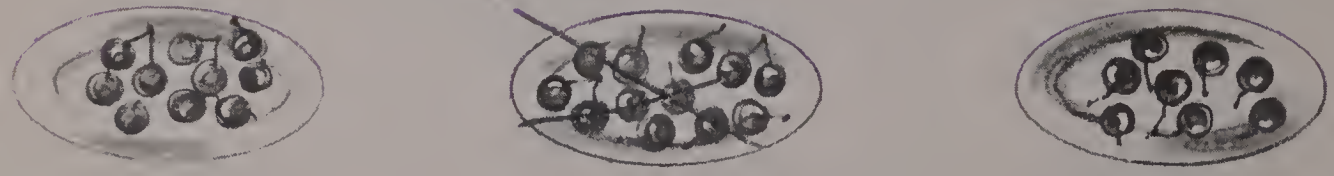
2



3



4



5



6



7



TEST 5 SCORE
(number right) . . .

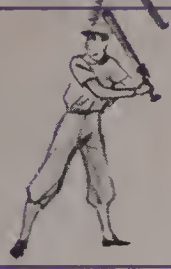
TEST 6

1





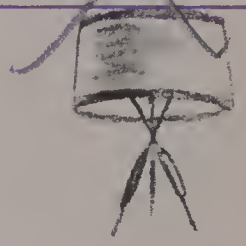
2



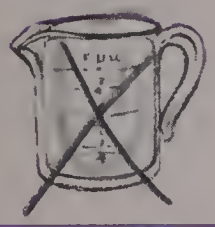
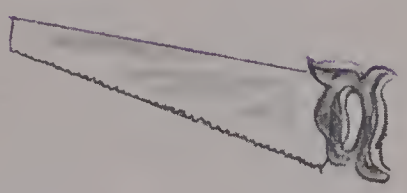


3

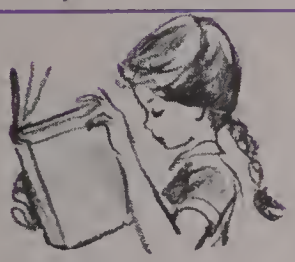
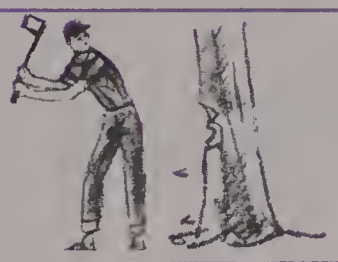


4

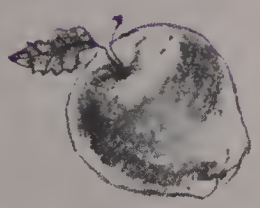
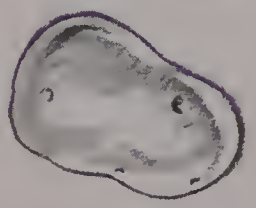




5

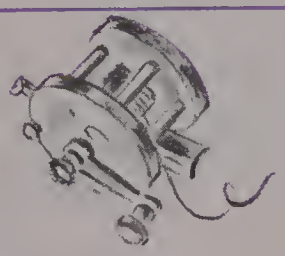
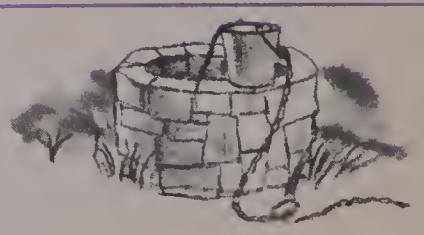





6


7

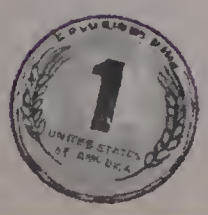




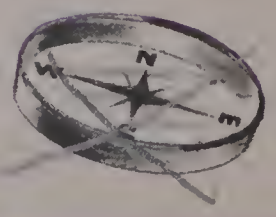
8





9



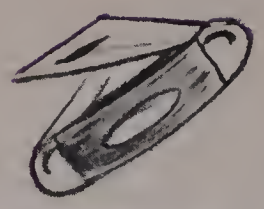



10

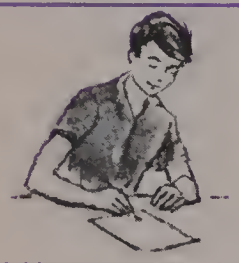




11

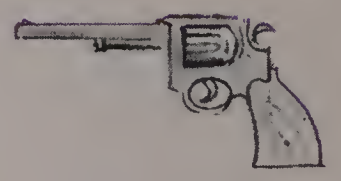

12





13



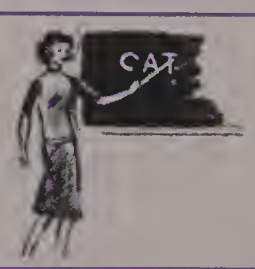
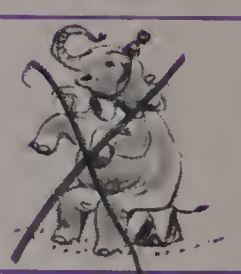


14





15

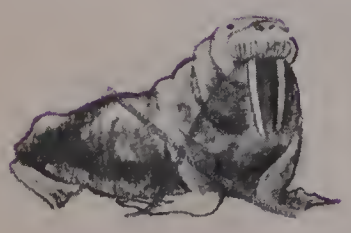
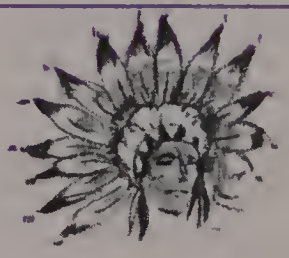
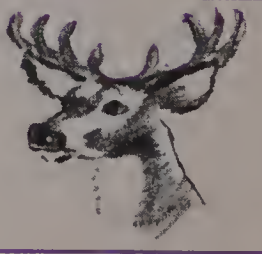




16

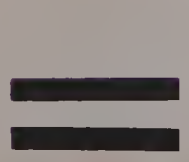




17

18




TEST 6 SCORE
(number right) . . .

TEST 7

1



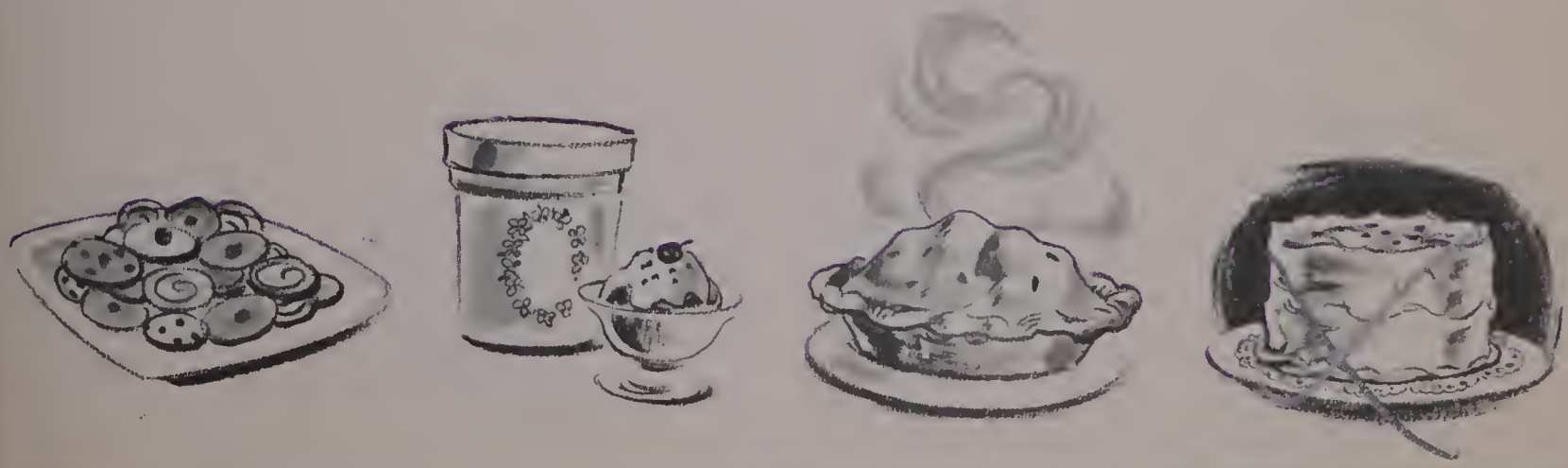
2



3



4



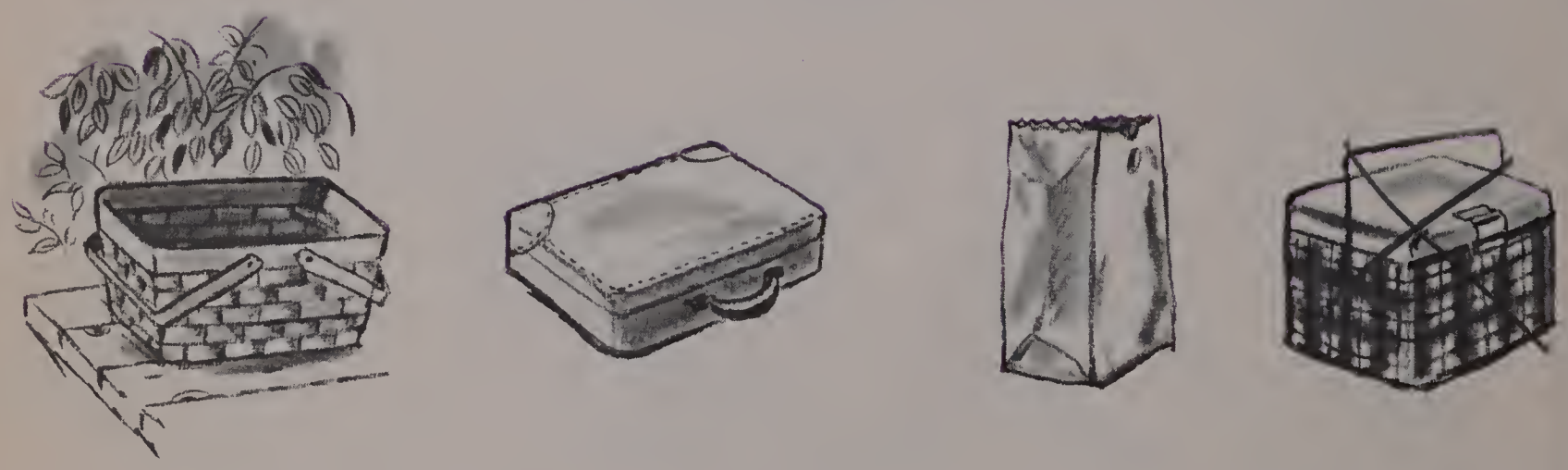
5



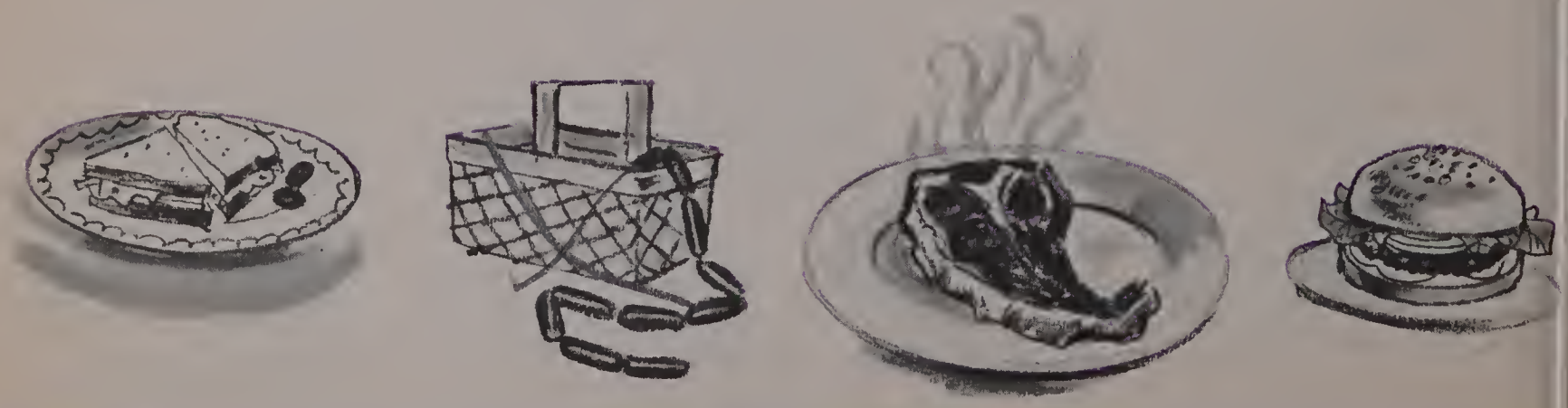
6



7



8



TEST 7 SCORE
(number right) . . .

CALIFORNIA SHORT-FORM TEST OF MENTAL MATURITY

1963 S-FORM/LEVEL 0

DEVISED BY E. T. SULLIVAN, W. W. CLARK, AND E. W. TIEGS

Name..... (Last / First / Middle)

School..... City.....

Boy Girl (Circle one) Grade..... Teacher or Examiner.....

Date of Test..... (Year / Month / Day)

Date of Birth..... (Year / Month / Day)

C.A. ..... (Years / Months) ( ) (Total Mos.)

TEST/FACTOR	1. OPPOSITES	2. SIMILARITIES	3. ANALOGIES	I. LOGICAL REASONING	4. NUMERICAL VALUES	5. NUMBER PROBLEMS	II. NUMERICAL REASONING	III. VERBAL CONCEPTS (6. VERBAL COMPREHENSION)	IV. MEMORY (7. DELAYED RECALL)	LANGUAGE (Tests 5, 6, 7)	NON-LANGUAGE (Tests, 1, 2, 3, 4)	TOTAL	I.S.I.†		LANGUAGE	NON-LANGUAGE	TOTAL	
POSSIBLE SCORE	7	8	8	23	8	7	15	18	8	33	31	64						M.A.‡
RAW SCORE													ACTUAL G.P.					RAW SCORE
PERCENTILE*													GRADE C.A.					I.Q.‡



1963 S-FORM LEVEL 1

CALIFORNIA SHORT-FORM TEST OF MENTAL MATURITY

DEVISED BY ELIZABETH T. SULLIVAN, WILLIS W. CLARK, AND ERNEST W. TIEGS

TO BOYS AND GIRLS:

This booklet has some games you will enjoy. Each game will show how well you can think. Do as much as you can in each game.

Do not turn this page until told to do so.

PUBLISHED BY CALIFORNIA TEST BUREAU/A DIVISION OF McGRAW HILL BOOK COMPANY, DEL MONTE RESEARCH PARK, MONTEREY, CALIFORNIA — COPYRIGHT © 1962 BY McGRAW-HILL, INC — ALL RIGHTS RESERVED — PRINTED IN THE UNITED STATES OF AMERICA — THIS WORK, OR ANY PARTS THEREOF, MAY NOT BE REPRODUCED IN ANY FORM WITHOUT PERMISSION OF THE PUBLISHERS.

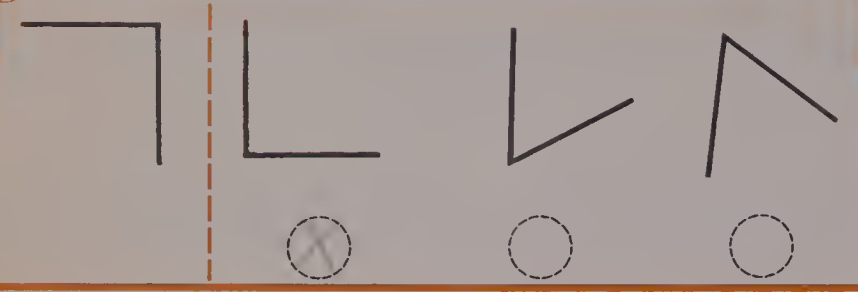
14TH PRINTING

TEST 1

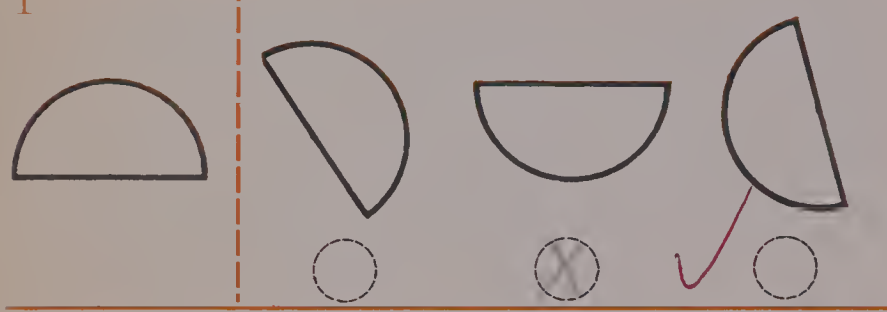
A



B



1



2



3



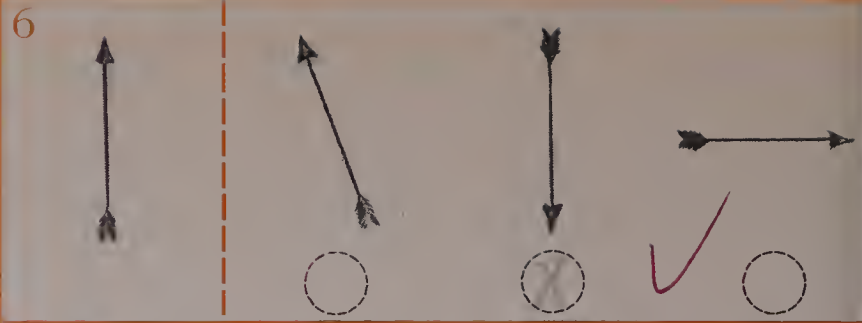
4



5



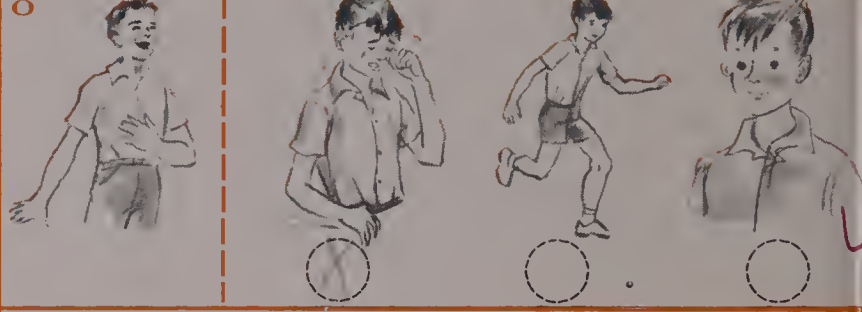
6



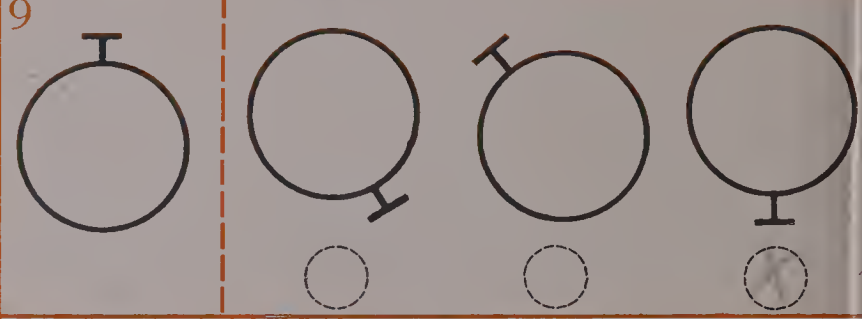
7



8



9



10



11



12

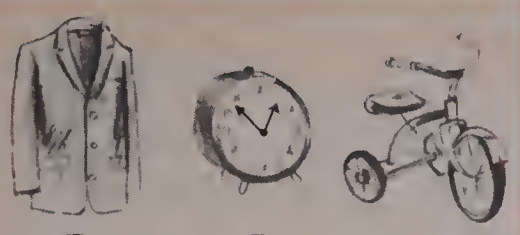


TEST 1 SCORE
(number right) . . .

TEST 2

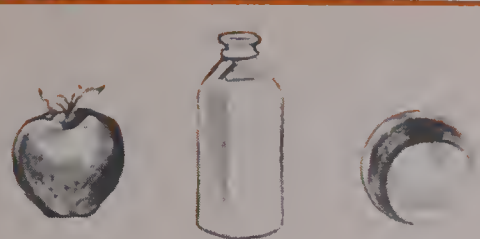
C





D





1





2





3





4





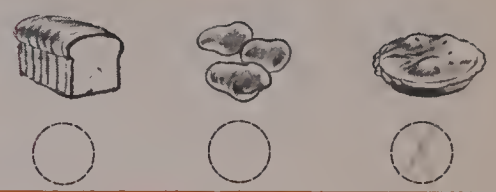
5



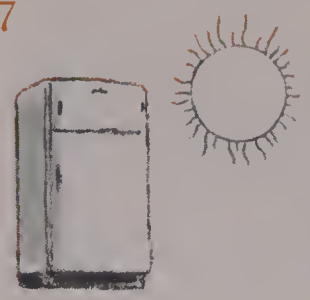


6





7





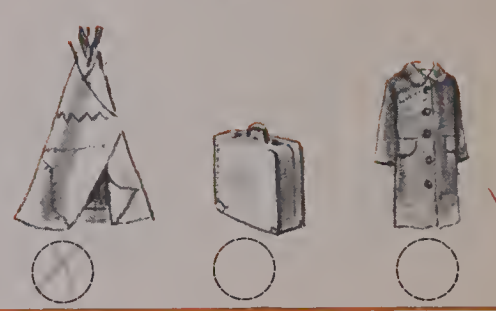
8





9





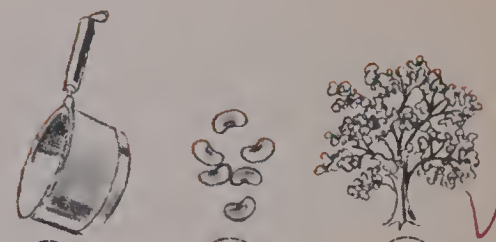
10





11





12





TEST 2 SCORE (number right) . . . 12

TEST 3

E



F



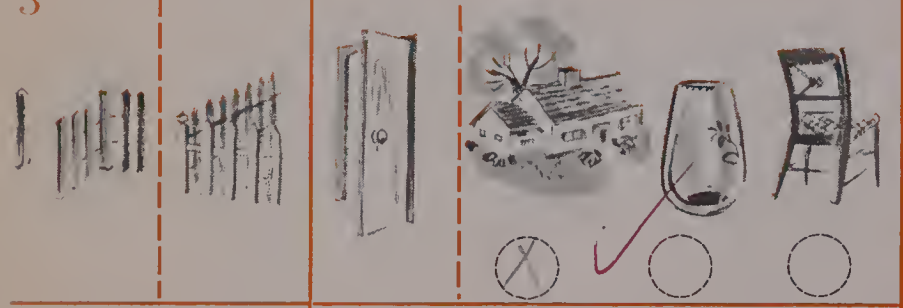
1



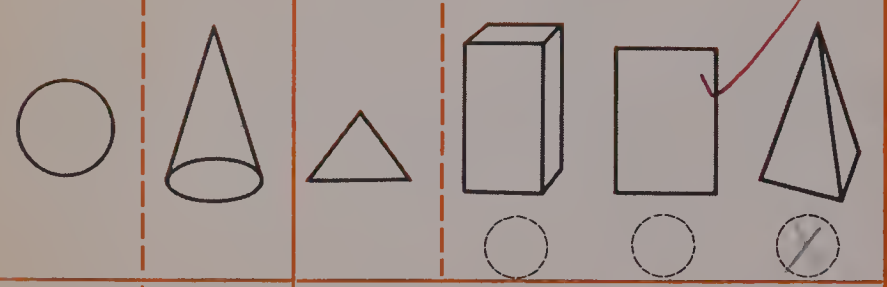
2



3



4



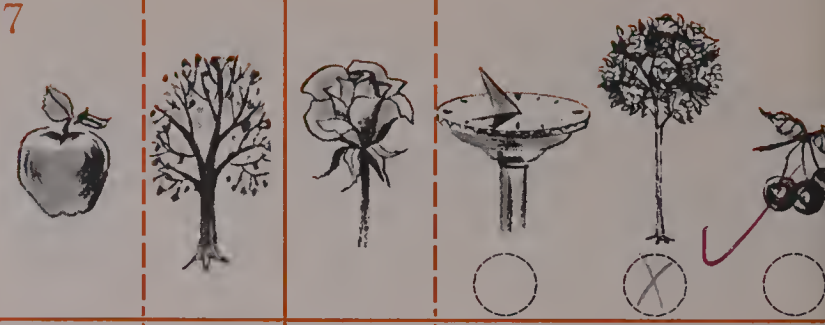
5



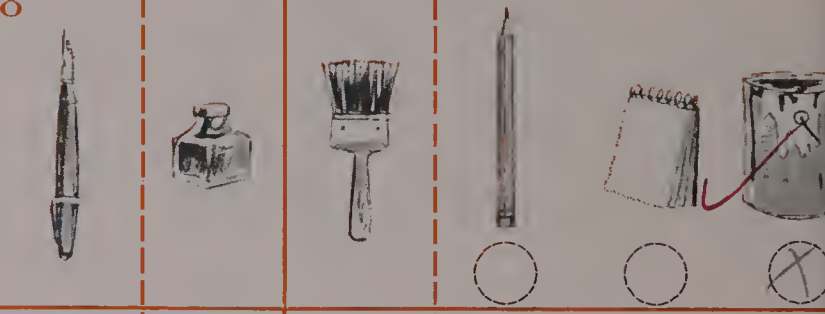
6



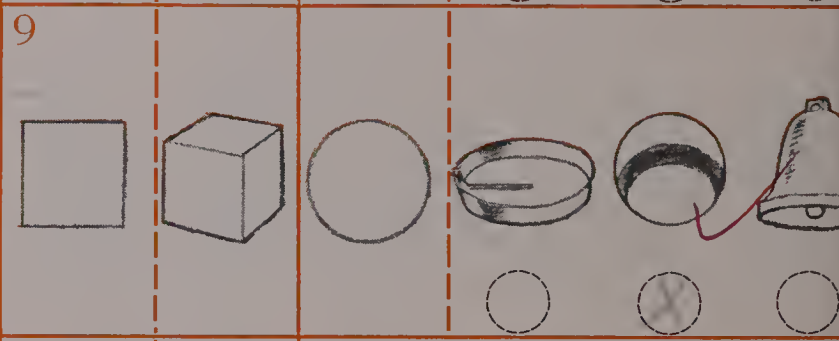
7



8



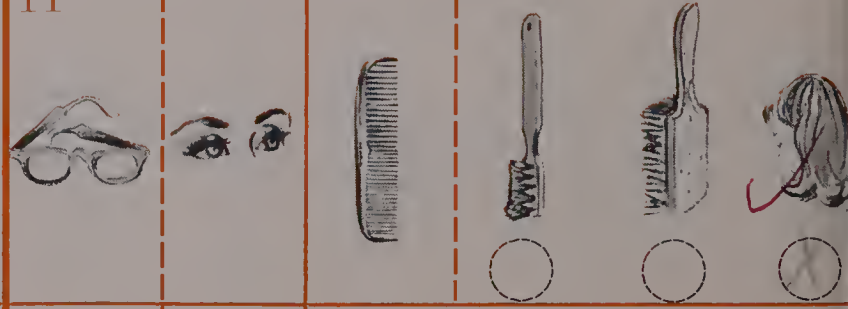
9



10



11



12



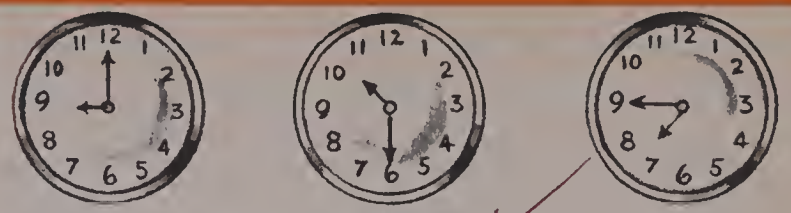
TEST 3 SCORE (number right) . . . 12

TEST 4

G



8



1



H



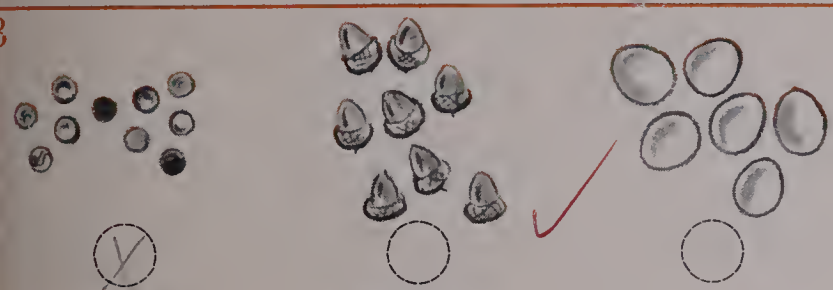
2



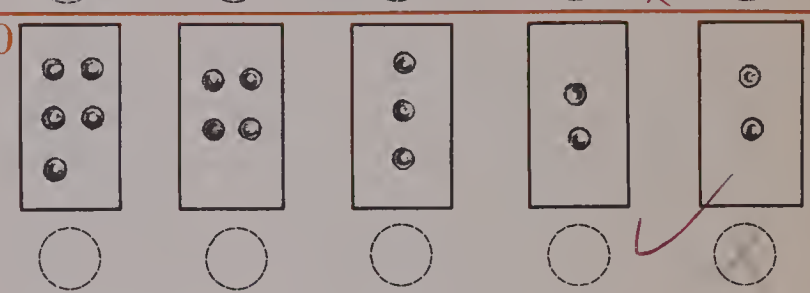
9



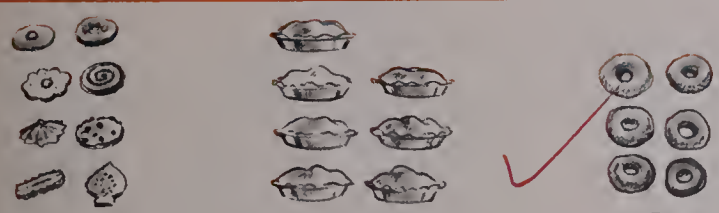
3



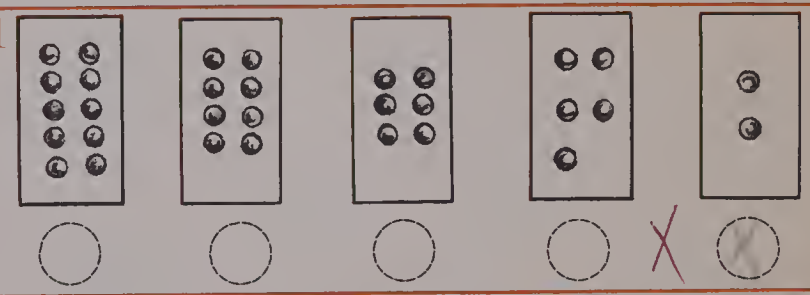
10



4



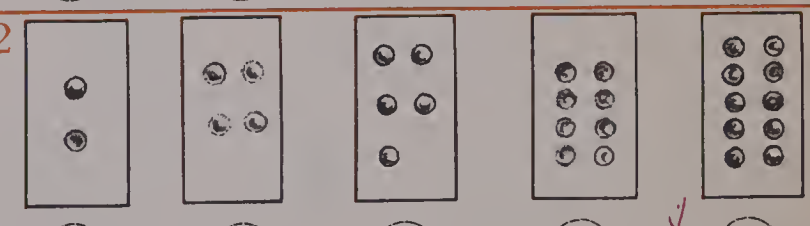
11



5



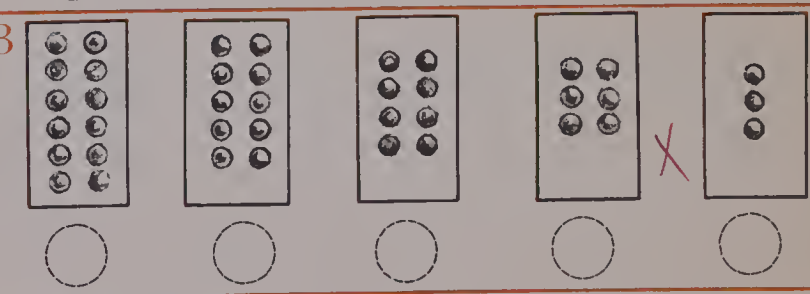
12



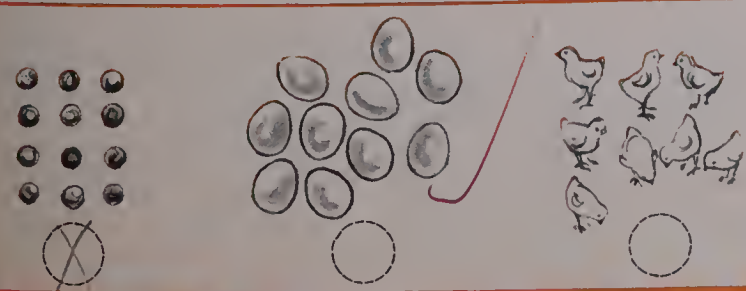
6



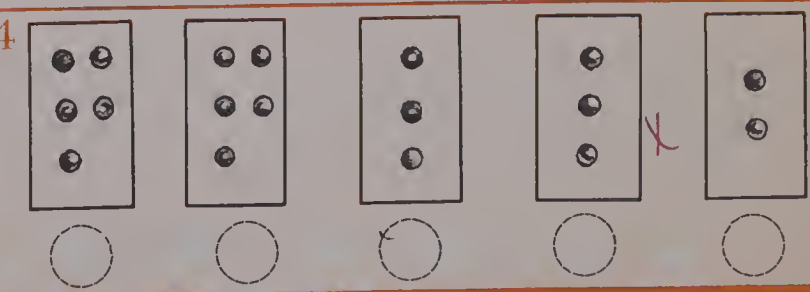
13



7



14



TEST 4 SCORE (number right) . . . 9

TEST 5

I



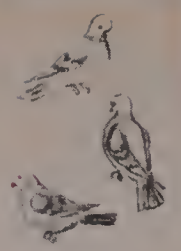






5









J









6









1









7







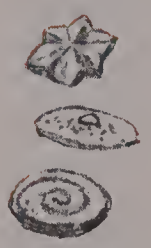


2







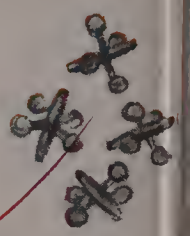


8









3







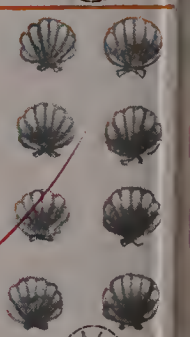


9









4

10

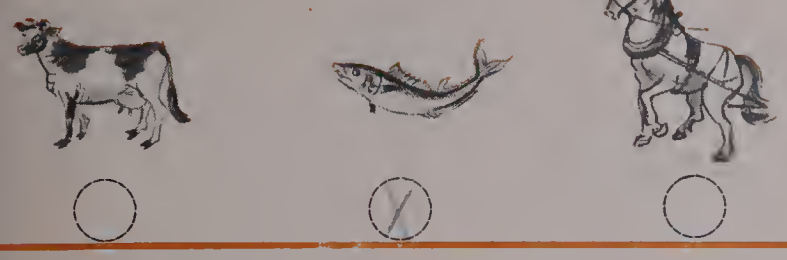
TEST 5 SCORE (number right) . . . 10

TEST 6

K



L



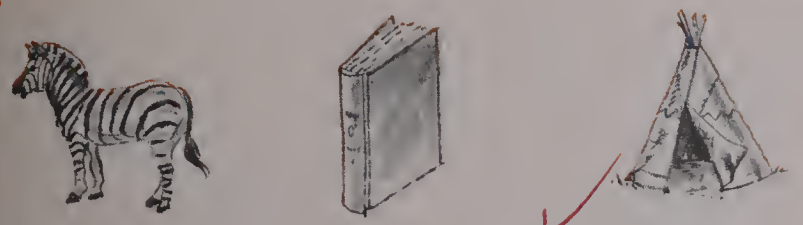
1



2



3



4



5



6



7



8



9



10



11



12



TEST 6 (Continued)

13



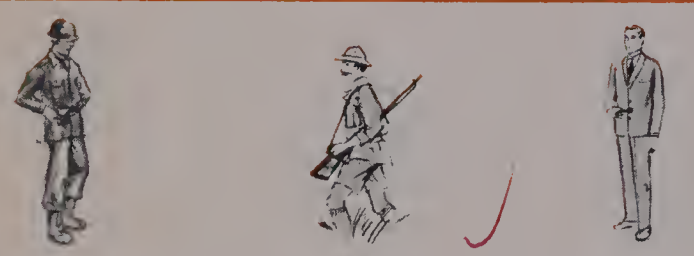
14



15



16



17



18



19



20



21



22



23



24



25

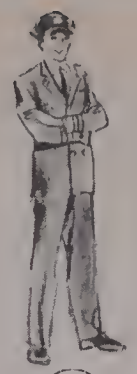
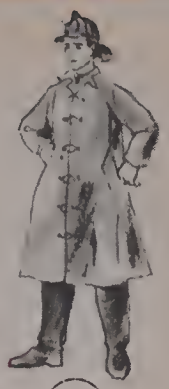


TEST 6 SCORE (number right) . . . 20

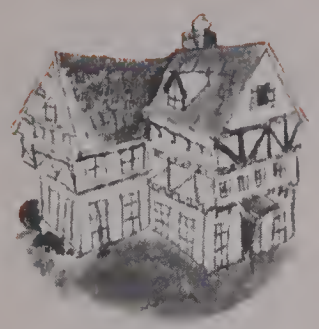
TEST 7

M



1



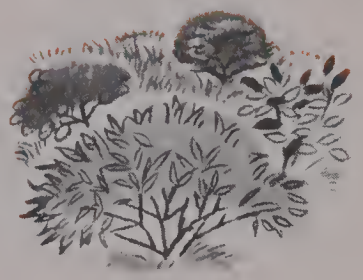
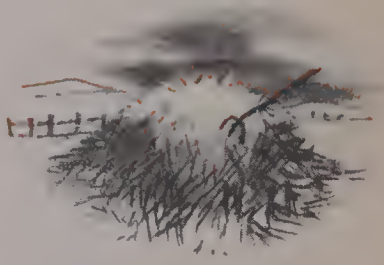
2



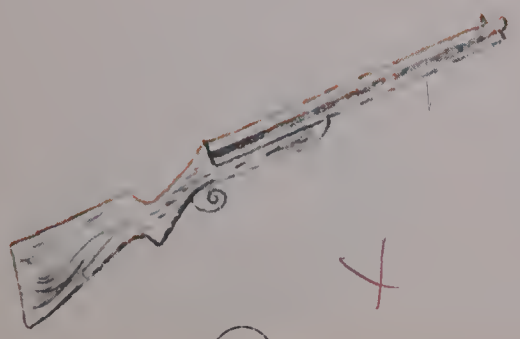


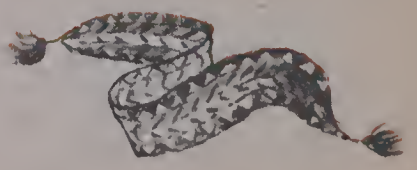

3



4



TEST 7 (Continued)

5

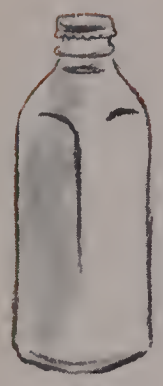




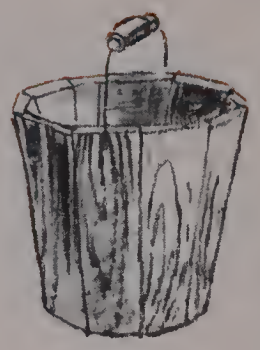




6

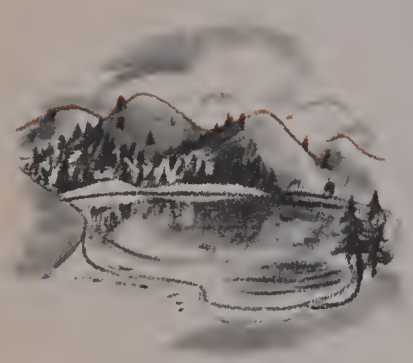




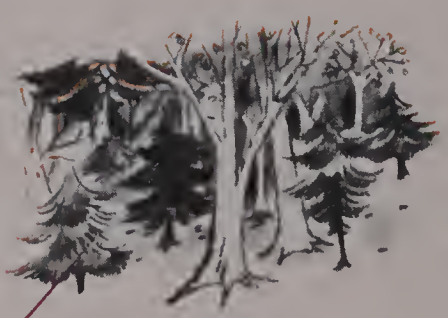




7

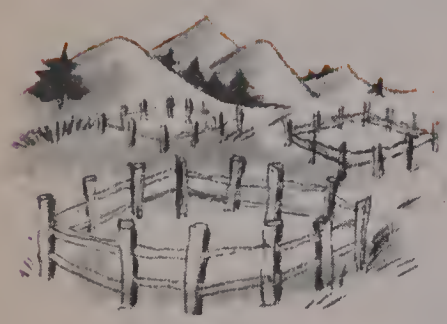






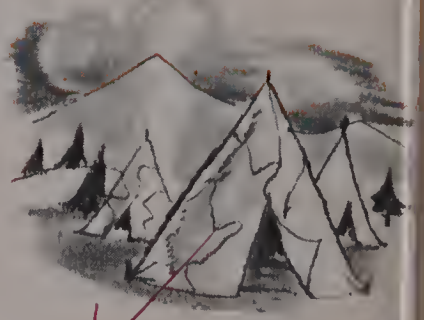


8







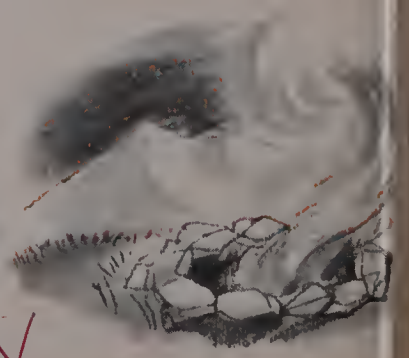


9









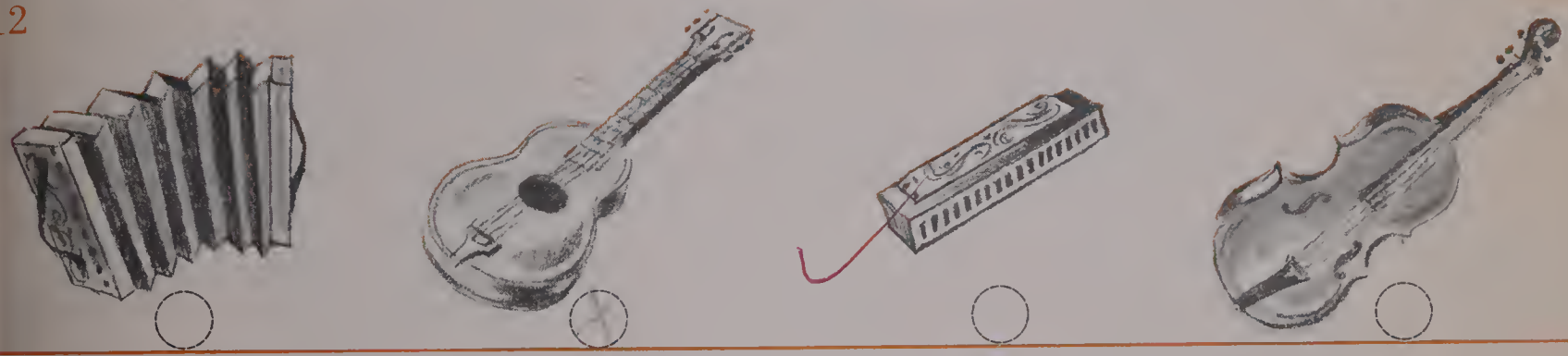
10



11



12



13



14



15



TEST 7 SCORE
(number right)

CALIFORNIA SHORT-FORM TEST OF MENTAL MATURITY

1963 S-FORM/LEVEL 1

DEVISED BY E. T. SULLIVAN, W. W. CLARK, AND E. W. TIEGS

Name [redacted] (Last) (First) (Middle)

School [redacted] City

Boy (Girl) (Circle one) Grade 2 Teacher or Examiner

Date of Test 1970 (Year) May (Month) 7 (Day)

Date of Birth 1962 (Year) June (Month) 20 (Day)

C.A. 7 (Years) 11 (Months) (95) (Total Mos.)

TEST / FACTOR	1. OPPOSITES	2. SIMILARITIES	3. ANALOGIES	I. LOGICAL REASONING	4. NUMERICAL VALUES	5. NUMBER PROBLEMS	II. NUMERICAL REASONING	III. VERBAL CONCEPTS (6. VERBAL COMPREHENSION)	IV. MEMORY (7. DELAYED RECALL)	LANGUAGE (Tests 5, 6, 7)	NON-LANGUAGE (Tests, 1, 2, 3, 4)	TOTAL	I.S.I.†
POSSIBLE SCORE	12	12	12	36	14	10	24	25	15	50	50	100	
RAW SCORE	11	12	12		9	10		20	8	38	44	82	ACTUAL G.P.
PERCENTILE*													GRADE C.A.

	LANGUAGE	NON-LANGUAGE	TOTAL	
M.A.‡				
RAW SCORE	38	44	82	
I.Q.‡	101	115	109	

STANDARD SCORE

STANINE

INTELLIGENCE QUOTIENT

PERCENTILE RANK

*Unless otherwise indicated, national norms

t your
e here .....

old are you? .....

n is your birthday? .....

e .....Date .....

ol..... Teacher .....

VOCABULARY SAMPLES

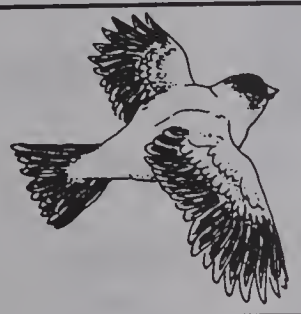
A.



did egg

dog two

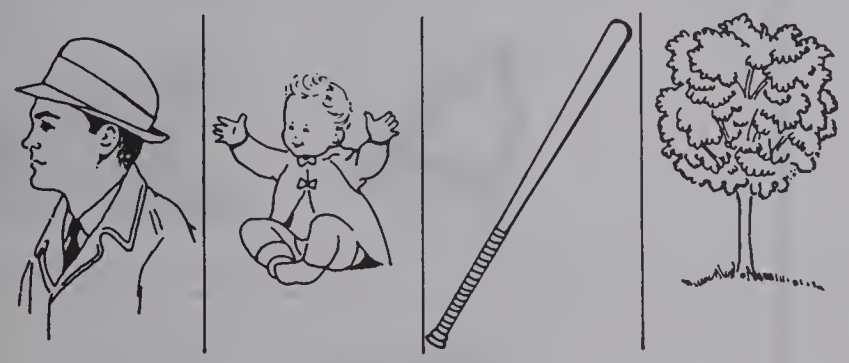
B.



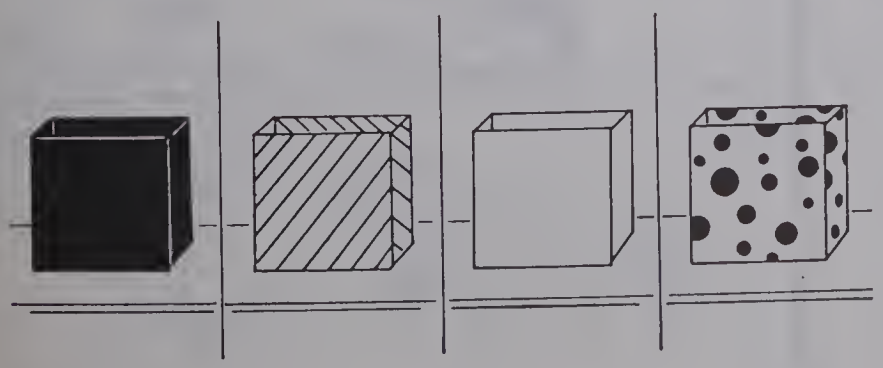
bed swim

milk fly

COMPREHENSION SAMPLES



A. Where is the baby?



B. The white box is on the shelf.

GATES–MacGINITIE READING TESTS

A
FORM 1

PRIMARY A, FORM 1

Vocabulary and Comprehension

■□□□□□□□□□□□

TEACHERS COLLEGE PRESS
TEACHERS COLLEGE
COLUMBIA UNIVERSITY
NEW YORK

To the Teacher:

BE SURE to follow the directions in the Manual (included in each test package) when giving these tests. The directions will tell you how to explain the tests and how to work the sample items with the students. Allow the exact time specified in the Manual.

VOCABULARY

Number correct _____

Standard score _____

Percentile score _____

Grade score _____

COMPREHENSION

Number correct _____

Standard score _____

Percentile score _____

Grade score _____

© 1964 by Teachers College, Columbia University

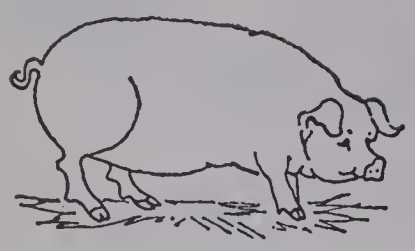
Printed in U.S.A.

10 9 8 7 6

START HERE

Vocabulary

1.



all pig

eye fly

2.

4

foot soup

door four

3.



duck fish

face rock

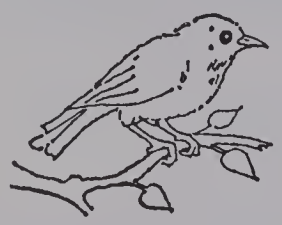
4.



made ball

girl cent

5.



bird bring

fire hard

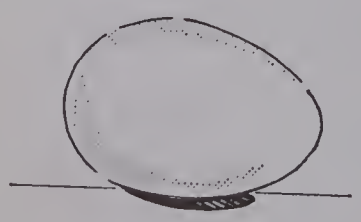
6.



made ball

play baby

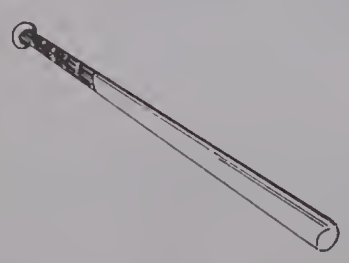
7.



had egg

eat not

8.



boy cow

arm bat

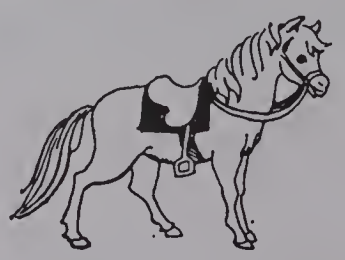
9.



tree dra

again tra

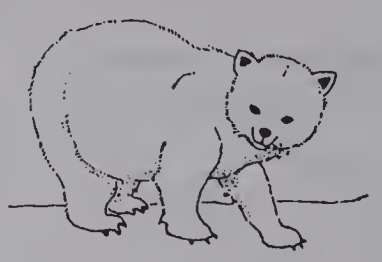
10.



pair pup

pony mon

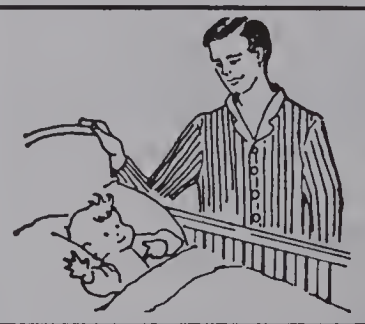
11.



bell be

star re

12.



father matc

fanning win

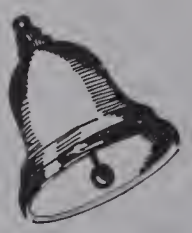
13.



oven ox

orange char

14.



help w

been h

15.



say c

pig i

16.



wolf t

work w



frog flag

floor clap



wheel wheat

what smell



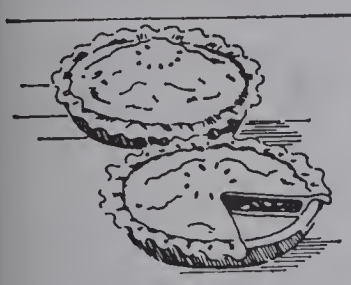
cook took

roof clock



fight lost

light lifts



pies rock

pick pink



lip stop

ship shoe



liking walking

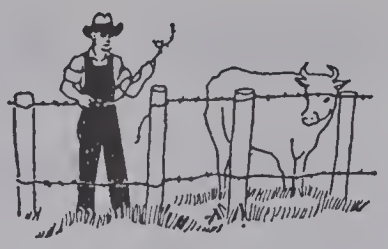
wanting talked



ride hide

hill made

25.



forty warmer

farmer falling

26.



stocking standing

splash something

27.



hall call

cart calf

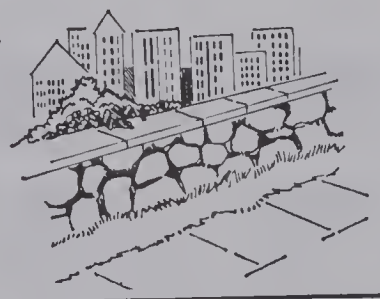
28.



wolf tail

take ship

29.



wall want

talk roll

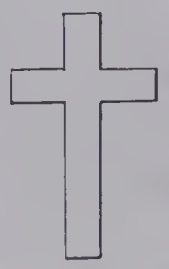
30.



bite wishes

wing write

31.



grass cross

loss crow

32.

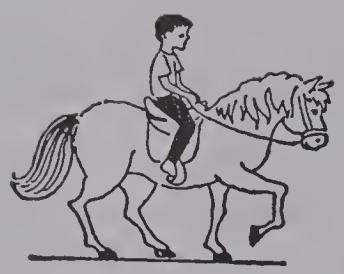


rock rope

hose rose

TURN THE PAGE

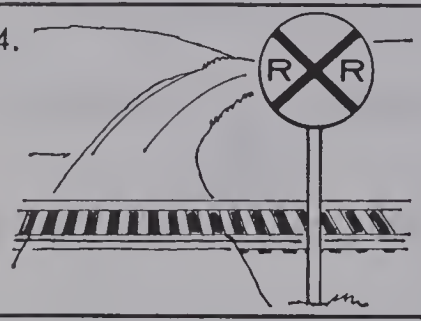
33.



raining river

riding hiding

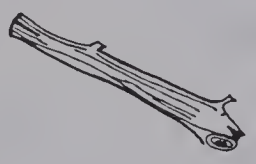
34.



railroad railing

rib roast rainbow

35.



shake late

stick skate

36.



family fair

pairs fairy

37.



dance daisy

prince down

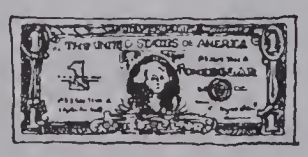
38.



stone stand

stay alone

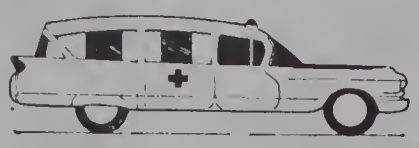
39.



doctor dollar

donkey dolly

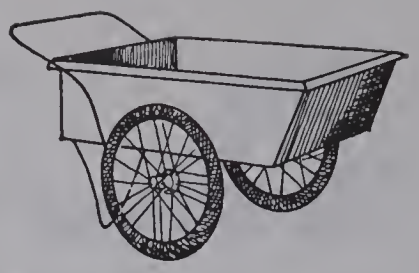
40.



ambulance American

adventure astronaut

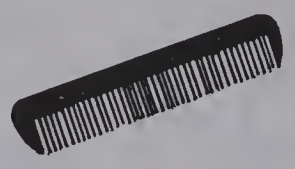
41.



card ca

part c

42.



lamb ca

comb co

43.



hand l

fans l

44.



fans b

mice f

45.



fix

lie

46.



point pri

poison dro

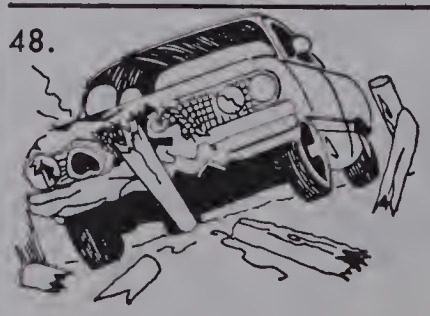
47.



neighbor migrat

mosquito microsc

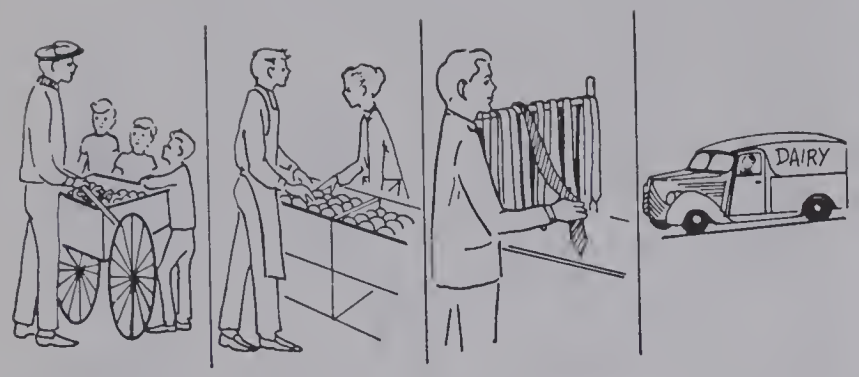
48.



accept accid

addition sandw

STOP



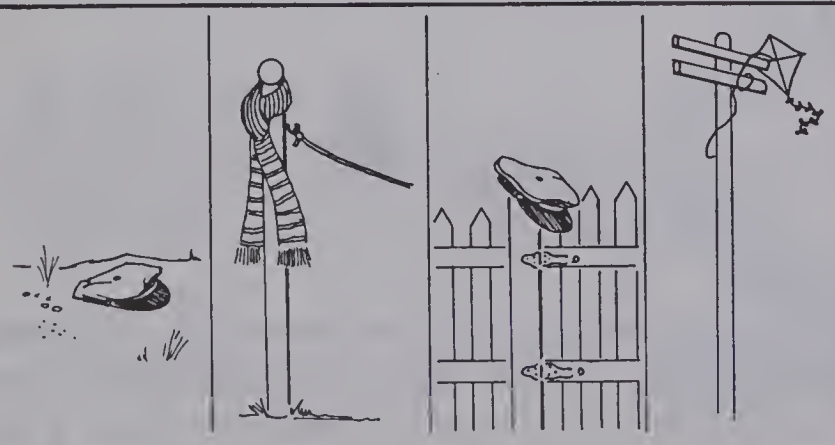
27. Every fine day Mr. Blake brought his cart to the corner. He sold peanuts and popcorn. After school, the boys often stopped to buy something. They often stayed for awhile to talk to Mr. Blake.



28. "Always wash your hands before eating," said Mother. One boy is doing what his mother told him to do.



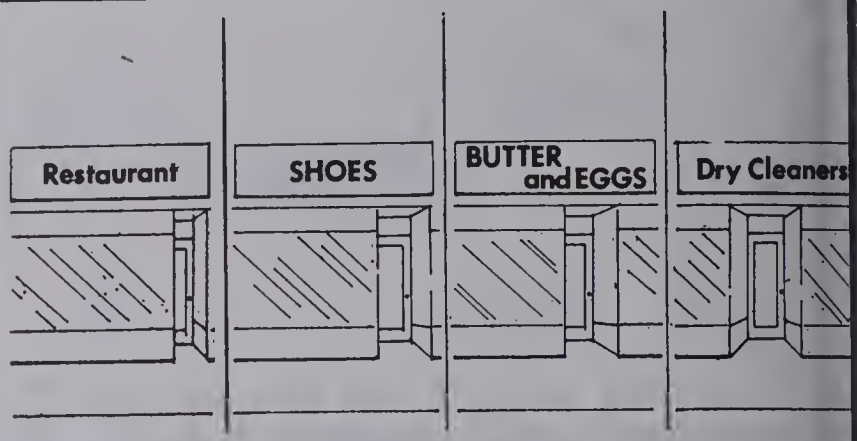
29. This elephant is in a circus. He does funny things to make the children laugh. The children give him peanuts.



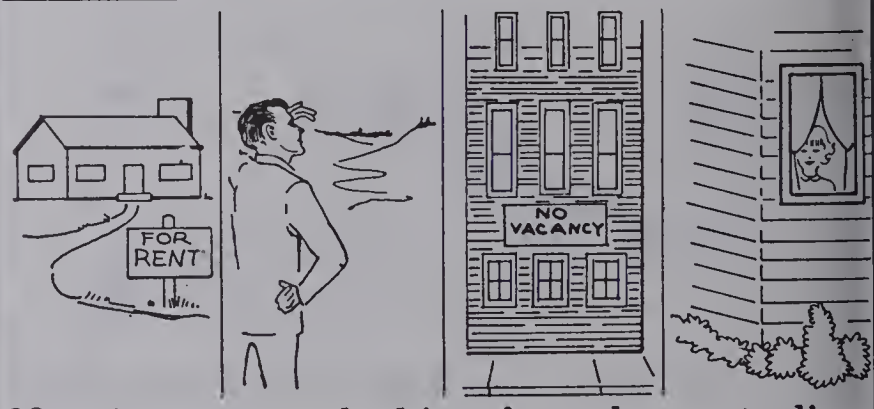
30. The strong wind during the storm had blown his new cap off the line. There it was on the gate post.



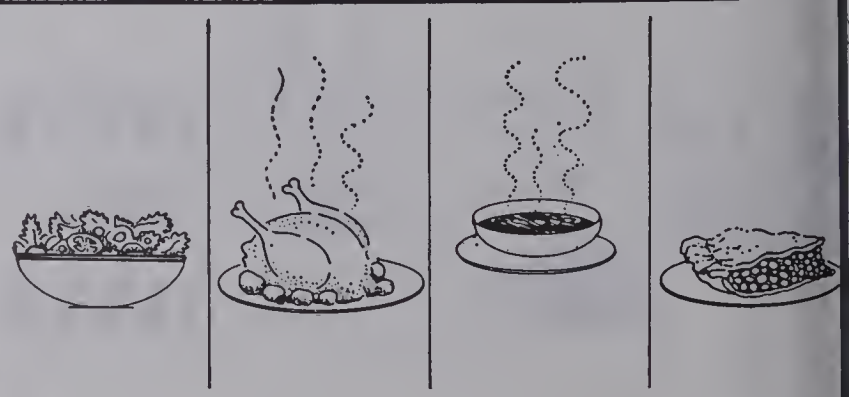
31. Which shows a sign that tells you to wat out for an animal?



32. Father should have his coat cleaned. I dropped some butter on it when he was eati Where does Father need to go?



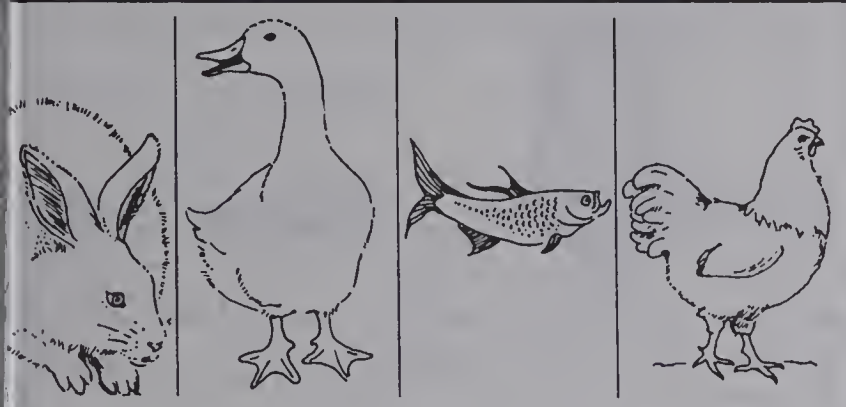
33. A man was looking for a house to live He passed many houses. Then he saw one whi he might rent. He went into this house. Whi house did he go into?



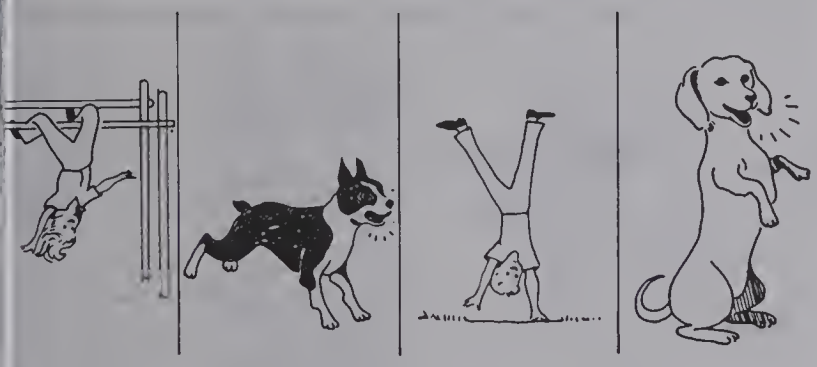
34. We had a big Thanksgiving dinner. Fi came soup and then turkey with vegetables. La came pie and cheese. What was the first thi we ate?



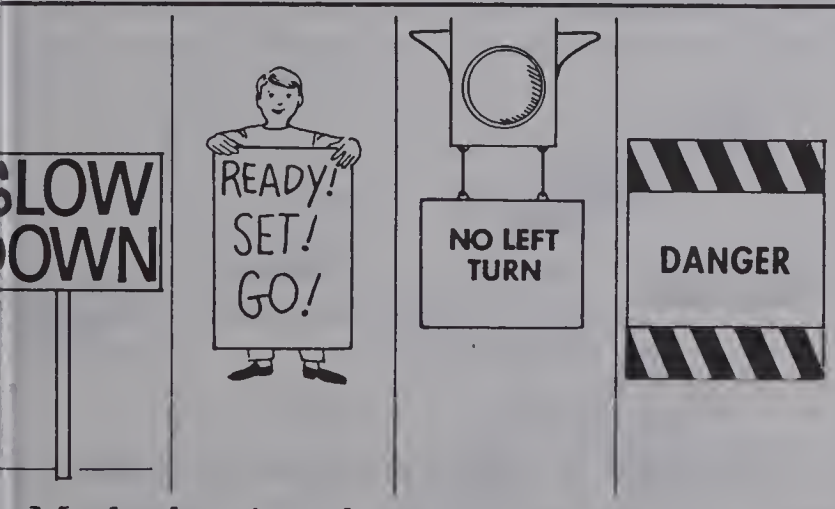
This boy is buying tickets to a movie.



The rabbit and the hen live on land. The lives in the water. The duck lives near the er. Which picture shows what lives in the er?



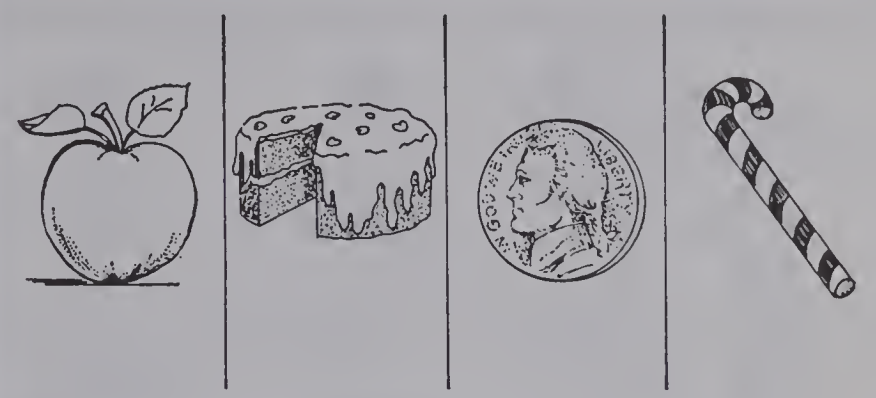
The dog that lives next door has learned eral tricks. His latest trick is to sit up on his hind legs and bark when he wants something eat. Which trick has he just learned to do?



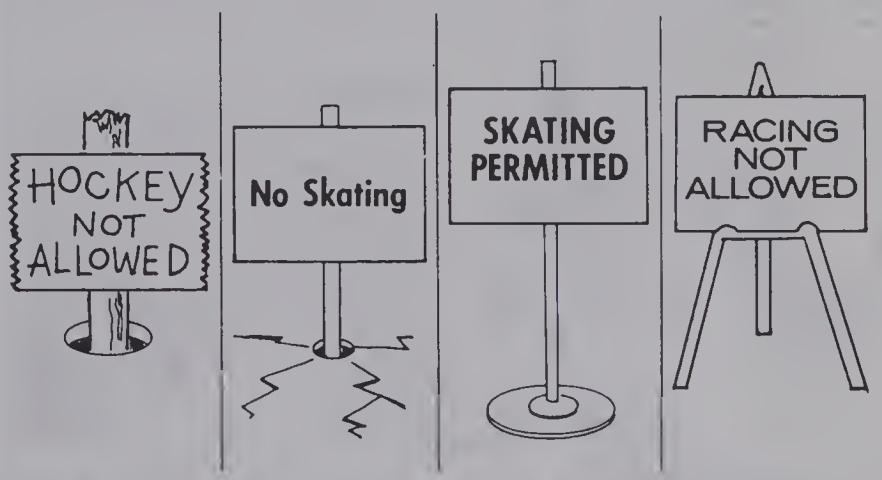
Mark the sign that means you should not n left.



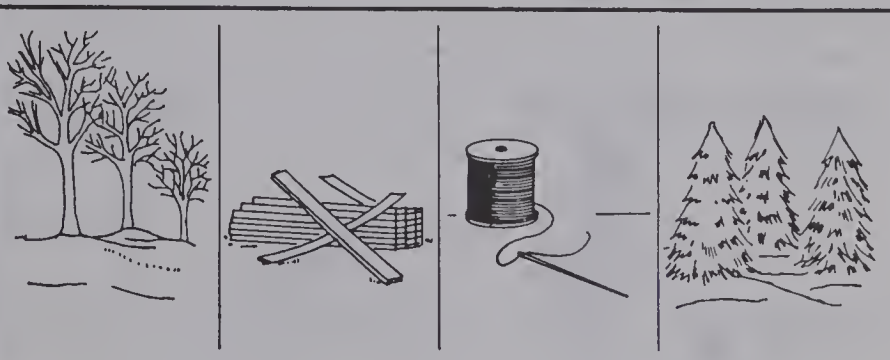
23. The snowman that lasted longest was the one that Jack made. It had four buttons, an umbrella, and a tall black hat.



24. A boy had five cents. He went to buy some candy. On the way to the store he saw some big apples for sale. He got an apple. What did the boy get with his money?

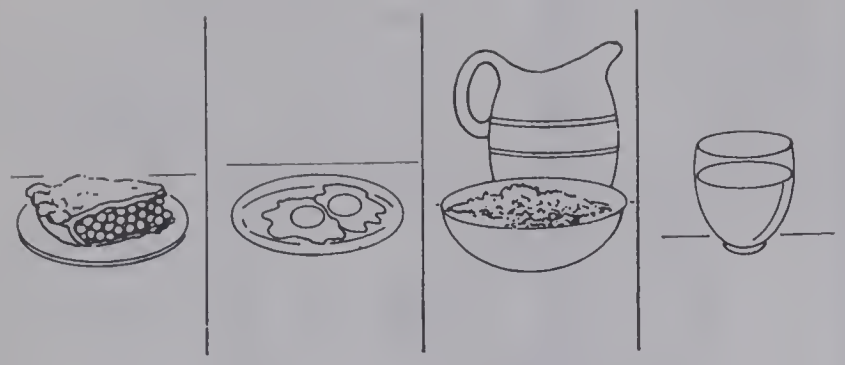


25. Which sign means that skating is not allowed?

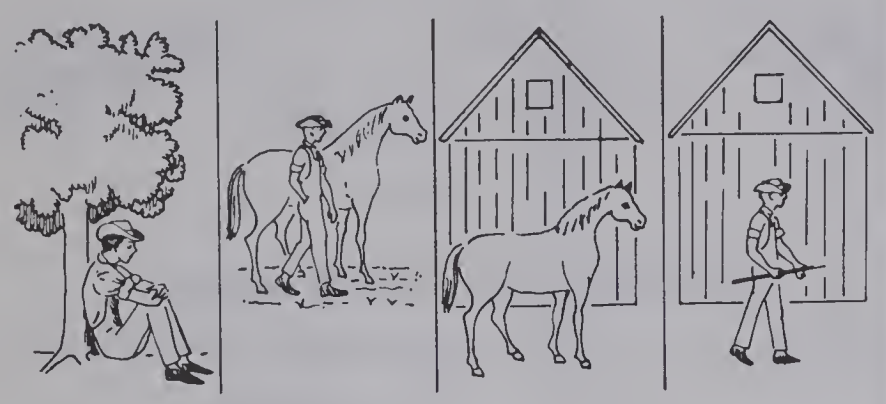


26. Firs, pines, and spruces are called evergreens because their needles stay green all year. These evergreen trees make good Christmas trees. They keep fresh for a long time after they have been cut.

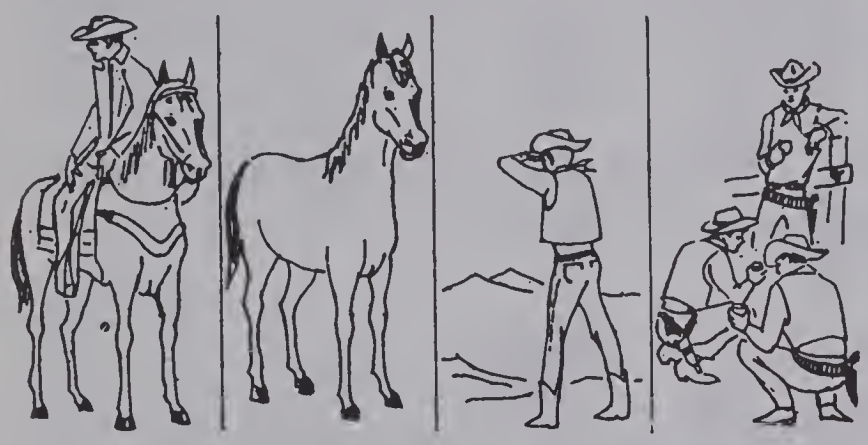
TURN THE PAGE



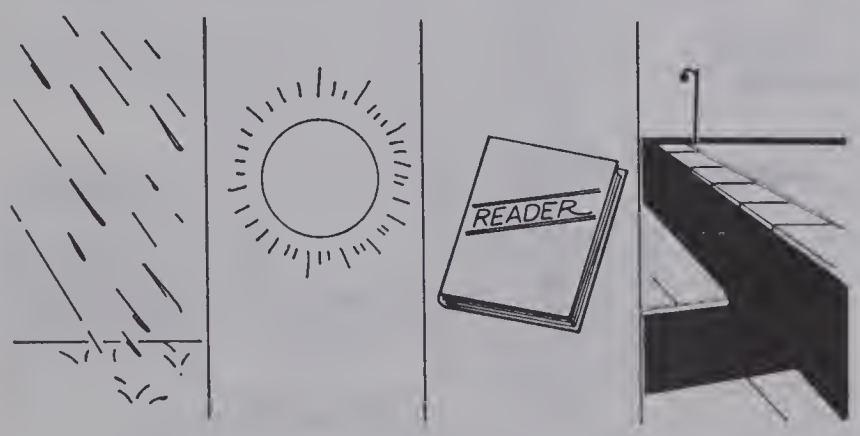
11. For breakfast he wanted a couple of fried eggs.



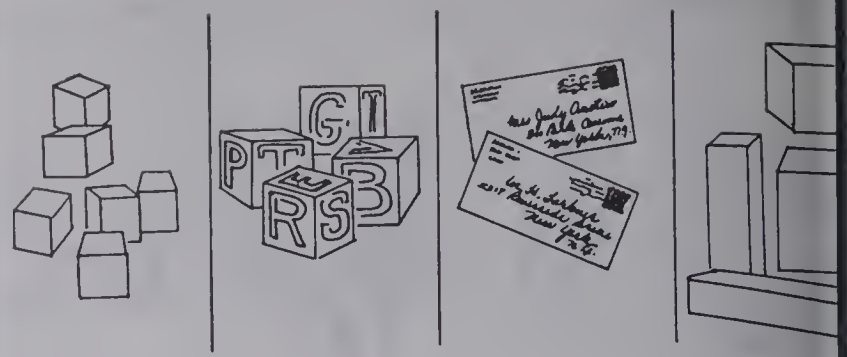
12. The farmer is walking near his barn.



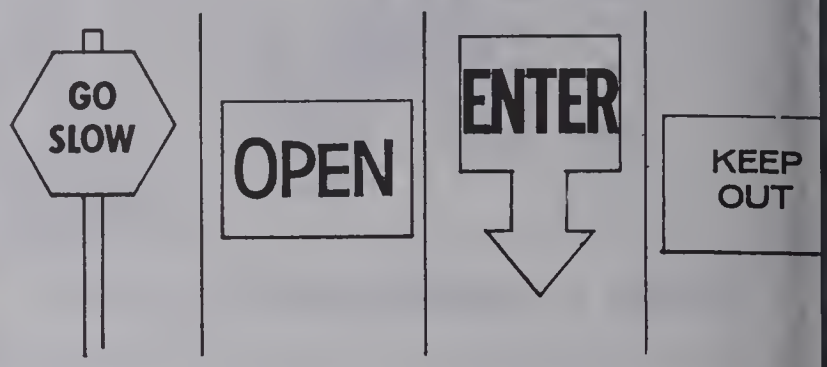
13. This cowboy has lost his horse.



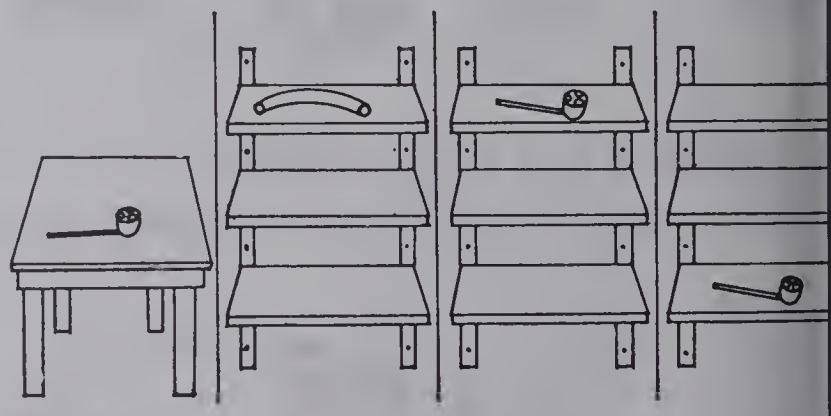
14. What will make the streets wet?



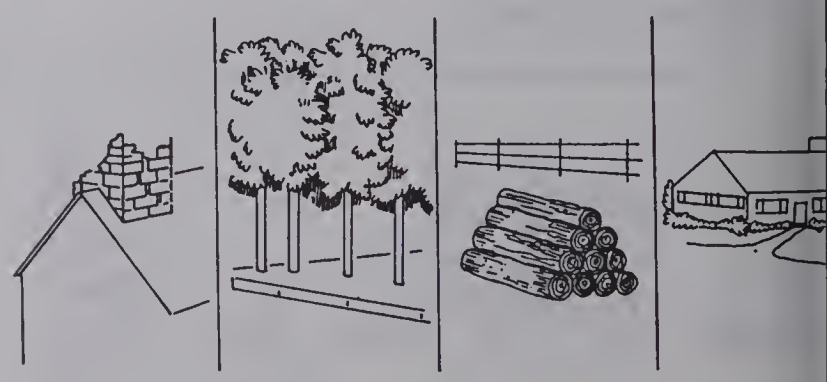
15. These blocks have letters on them.



16. Mark the picture of the sign that tells not to go in.



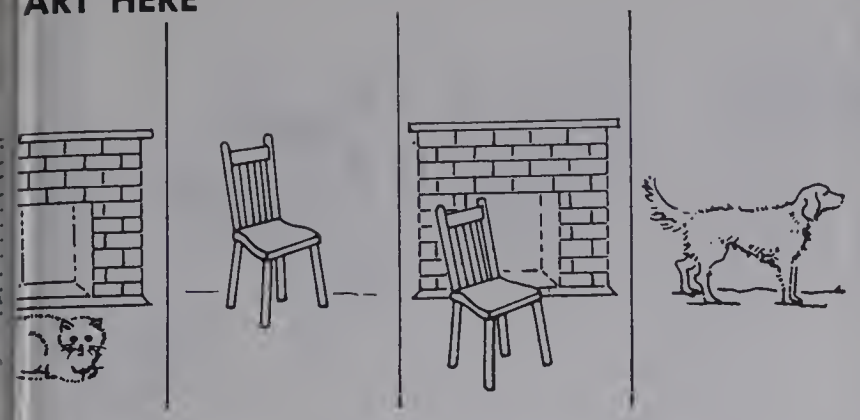
17. His best bubble pipe was on the top she



18. A strong wind caused damage to chimney of our house.

Comprehension

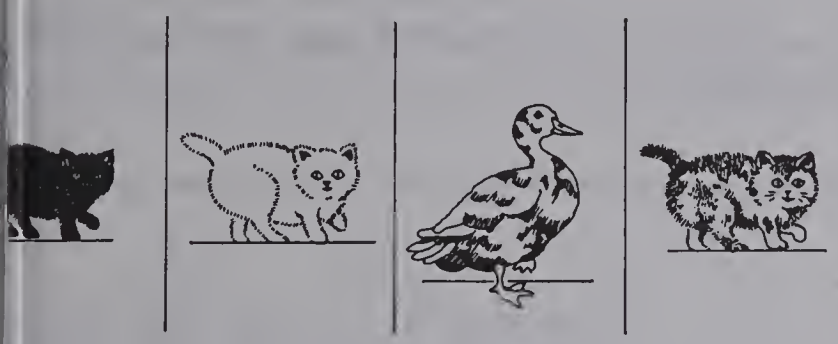
ART HERE



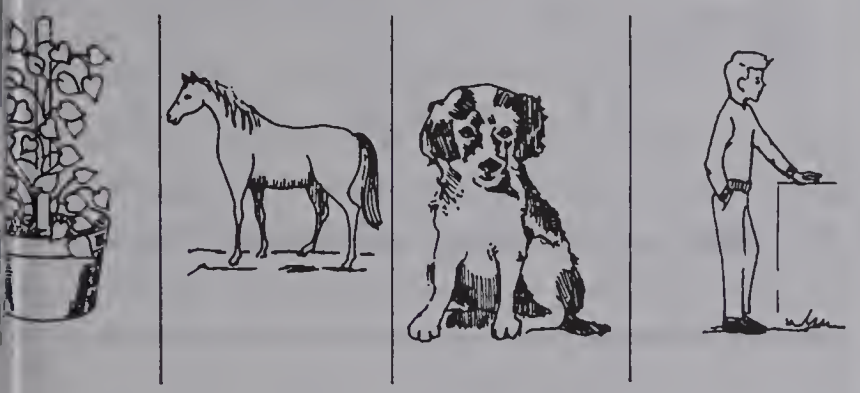
Mark the cat.



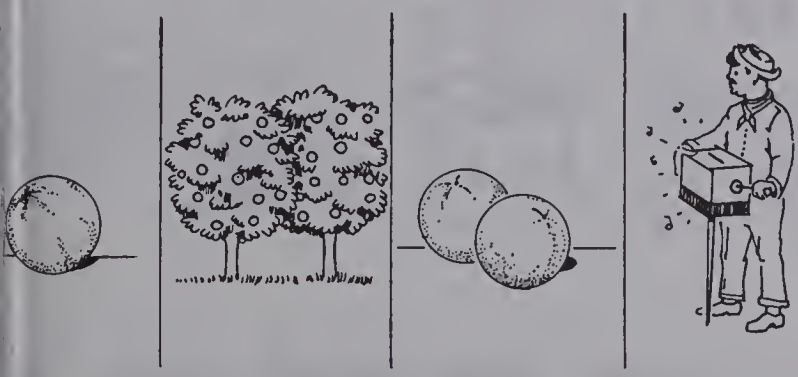
Which is the big tree?



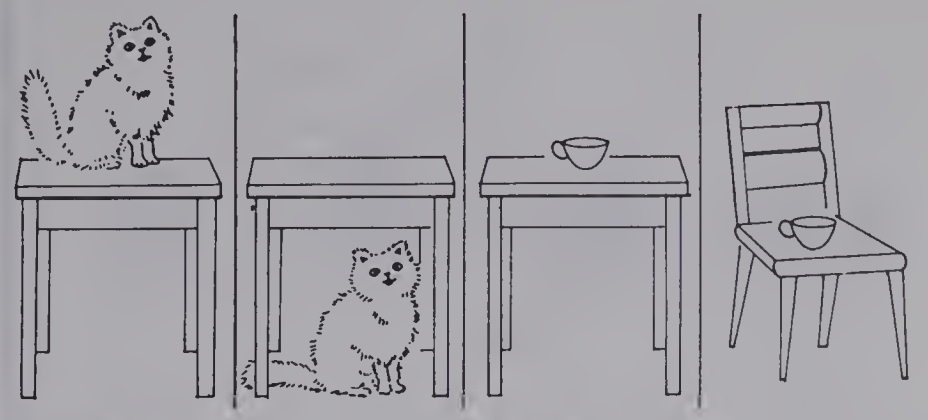
Here is the white kitten.



This is a boy.



Here are two oranges.



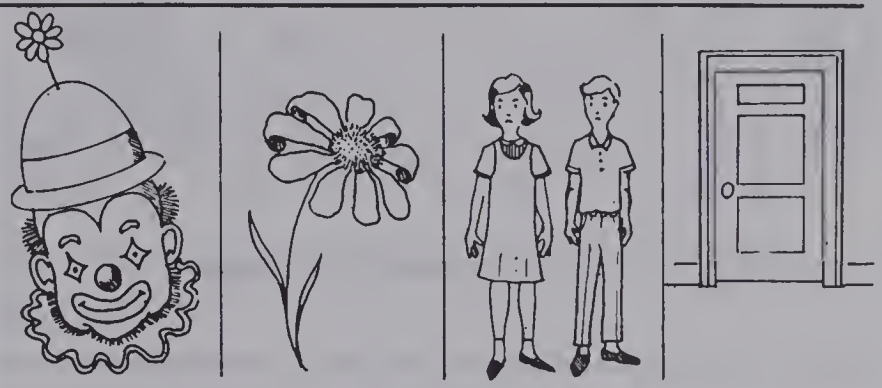
6. The cat is sitting on the table.



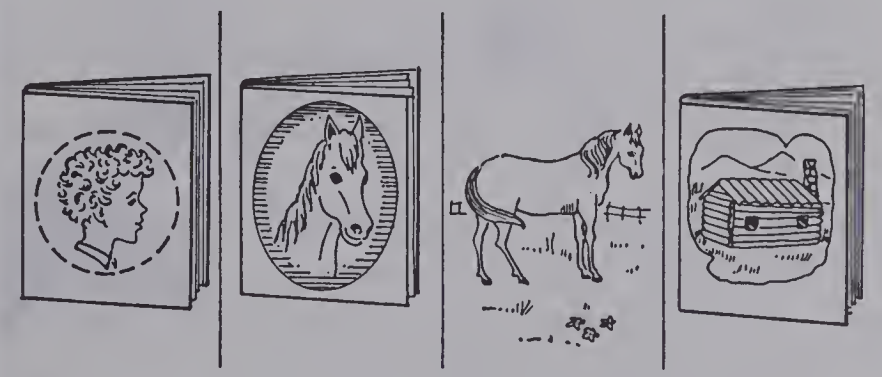
7. Mark the bird with a worm.



8. Who is reading from a little book?



9. What made the children laugh so hard?



10. The book she wanted was about horses.

TURN THE PAGE

t your
e here .....

old are you? .....

n is your birthday? .....

le .....Date .....

ol..... Teacher .....

VOCABULARY SAMPLES

A.



sleep only

store water

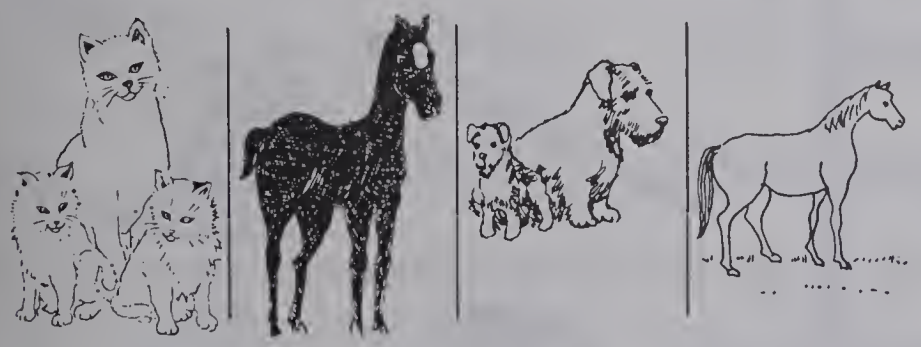
B.



boat hit

man burn

COMPREHENSION SAMPLES



A. Where is the black pony?



B. The children are making sand castles.

GATES–MacGINITIE READING TESTS

B
FORM 1

PRIMARY B, FORM 1

Vocabulary and Comprehension

TEACHERS COLLEGE PRESS
TEACHERS COLLEGE
COLUMBIA UNIVERSITY
NEW YORK

To the Teacher:

BE SURE to follow the directions in the Manual (included in each test package) when giving these tests. The directions will tell you how to explain the tests and how to work the sample items with the students. Allow the exact time specified in the Manual.

VOCABULARY

Number correct _____

Standard score _____

Percentile score _____

Grade score _____

COMPREHENSION

Number correct _____

Standard score _____

Percentile score _____

Grade score _____

© 1964 by Teachers College, Columbia University

Printed in U.S.A.

10 9 8 7

Vocabulary

START HERE

1. 

paper apple

land been

2. 

farmer party

inch paint

3. 

pebble stumble

asleep address

4. 

overcoat overthrow

overhead oyster

5. 

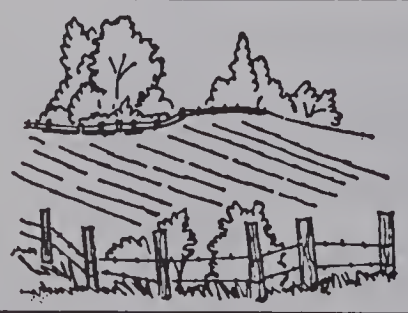
March indeed

sudden Indian

6. 

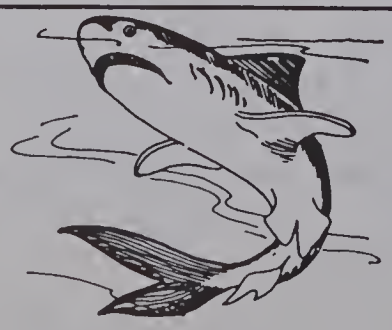
tooth through

incisive truth

7. 

room friend

warm field

8. 

shamble shark

sheer hark

9. 

bridge charg

bright escap

10. 

insect mer

inquire autho

11. 

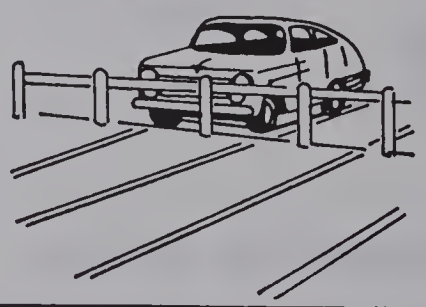
dinosaur sausa

diners downstai

12. 

bald bad

beau rid

13. 

parade cardboa

parking carvi

14. 

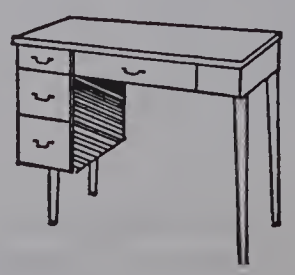
loose sw

worse swo

15. 

smooth ste

smell ves

16. 

check de

flesh dese



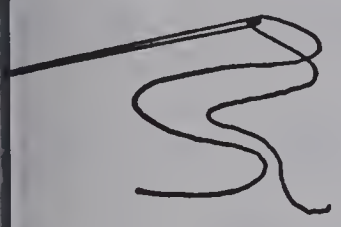
pantry launch

laundry lavish



cloudy cluster

closet differ



neglect saddle

needle seldom



joke juice

crime jewel



valley village

snow parson



thankful trust

ranch trash



shatter shave

sharpen servant

4.



beetle beguile

beet bridle

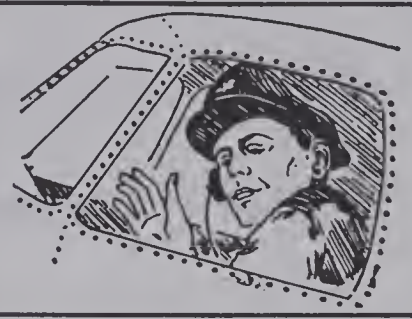
25.



stubborn marble

stumble stately

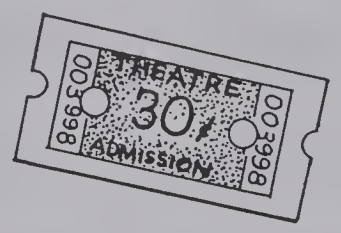
26.



pillow block

pilot double

27.



tricky thicker

rocket ticket

28.



squirrel sparrow

progress sparkle

29.



shout shoved

shoulder possible

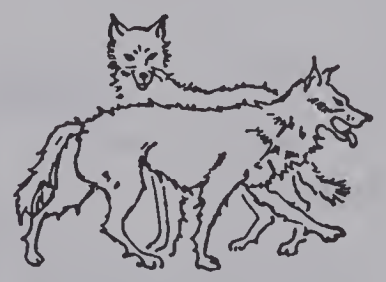
30.



amount announcer

northwest narrow

31.



wizard wove

wolves whereof

32.



musician physician

museum mysterious

TURN THE PAGE

33.



dust good-by

address goddess

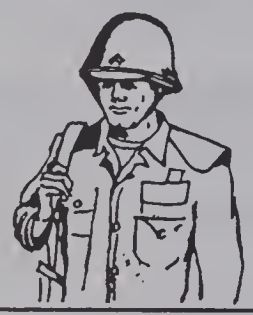
34.



harbor annual

anchor appetite

35.



weave military

mystery mirror

36.



shove cure

curve cover

37.



banjo bandage

blanket bandit

38.



chocolate chandelier

chimpanzee chiffonier

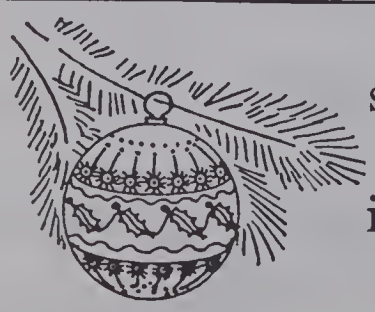
39.



avenue answer

boulder arrow

40.



settlement ordinary

innocent ornament

41.



throat threate

fever theat

42.



physician positi

pillow thirte

43.



tailor plumb

trailer sail

44.



symposium syndica

symphony sycamo

45.



advertise admir

moral affir

46.



doughnut dormito

drawbridge donati

47.



spoke shad

spark spad

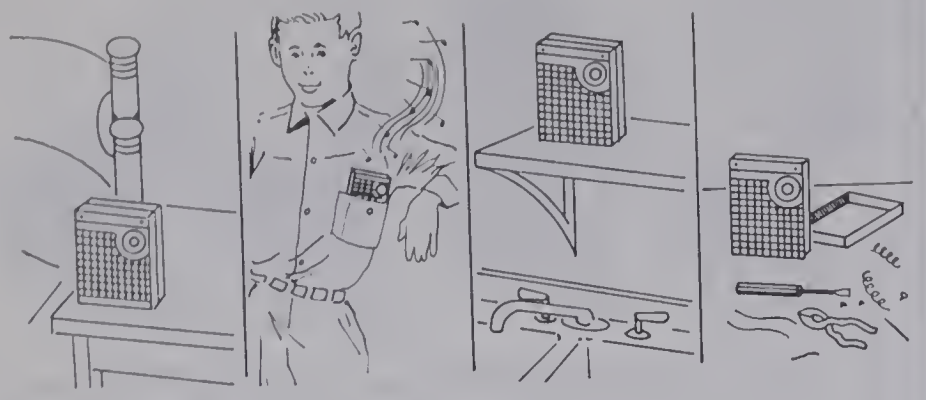
48.



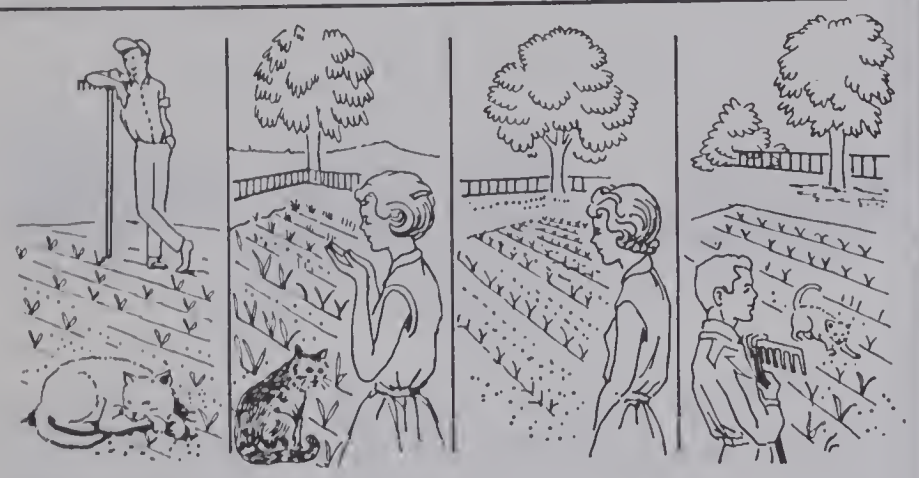
medical med

model medd

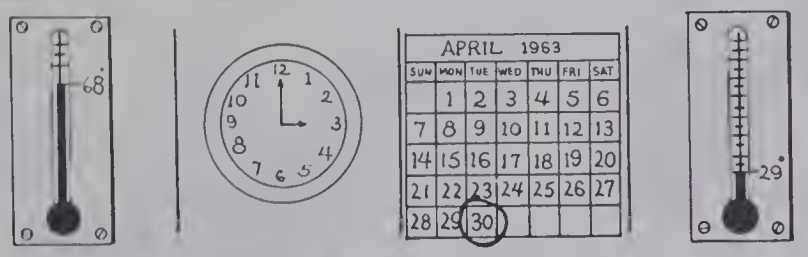
STOP



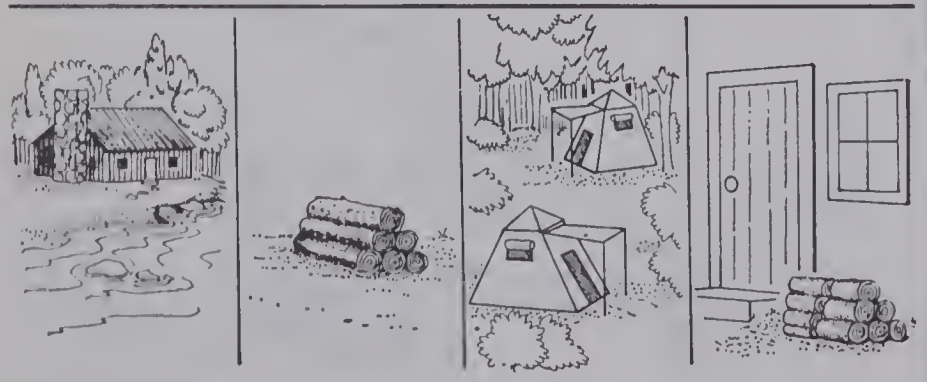
27. When Bill first got his little transistor radio, he carried it with him wherever he went. Now he usually leaves it at home on his bedside table. Mark the picture which shows where Bill usually leaves his radio now.



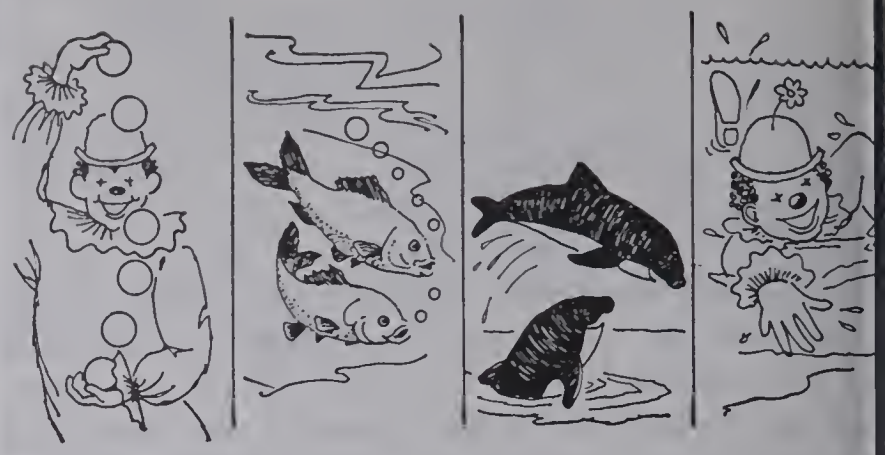
28. When Kathy came in, she told her family that there was a strange cat in the garden. Her mother went out to look, but the cat had disappeared.



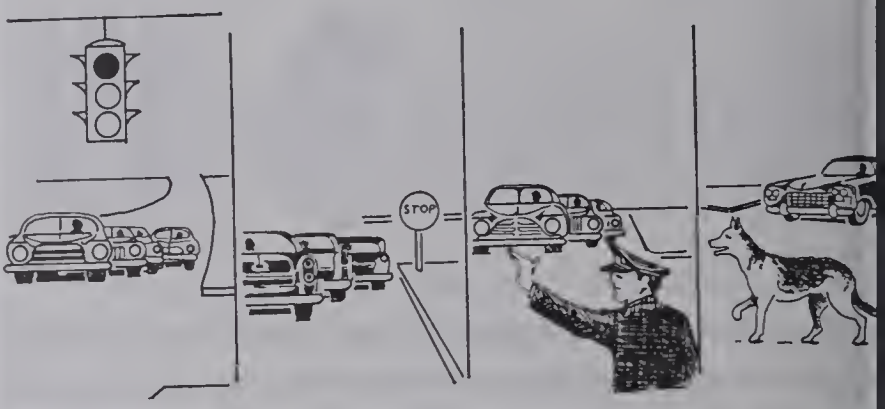
29. Orange growers watch the weather carefully. In Southern California, there are a great many oil burners ready in case the winter weather turns cold. These oil burners are called smudge pots. They give enough heat to protect the fruit if the temperature drops below the danger point of thirty degrees. What shows that the temperature is below the danger point?



30. When they reached their summer cabin, the Smiths were happy to see a woodpile near the back door. This meant that they could quickly start the two fires—one in the open fireplace and one in the wood-burning kitchen stove.



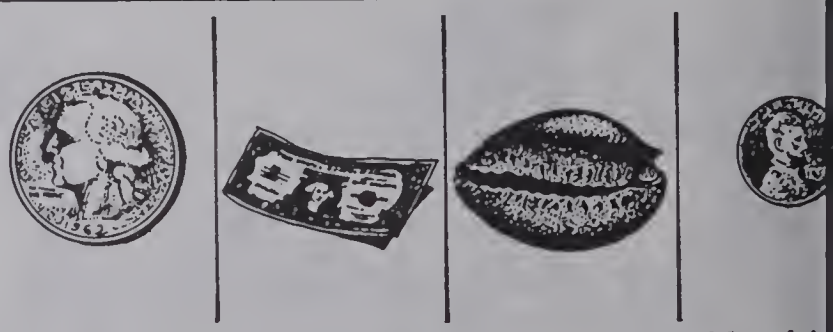
31. The porpoise is so playful that people often call a clown. When you watch a porpoise, it does seem to grinning and doing tricks.



32. At some busy intersections, a policeman dire traffic. At others, the traffic is controlled by traffic lig that change color automatically. Mark the picture t shows automatic traffic control.



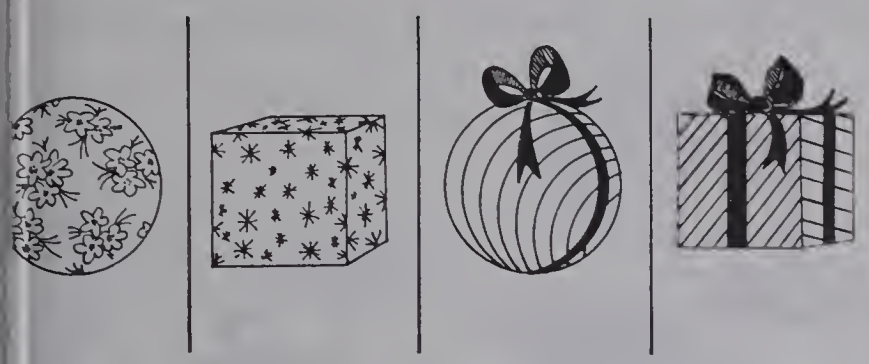
33. Hundreds of years ago, certain animals like horse, cow, and sheep were tamed and put to work man. Such animals are known as "domestic" anim Other animals, like lions, tigers, and bears, still rem wild. Which is a domestic animal?



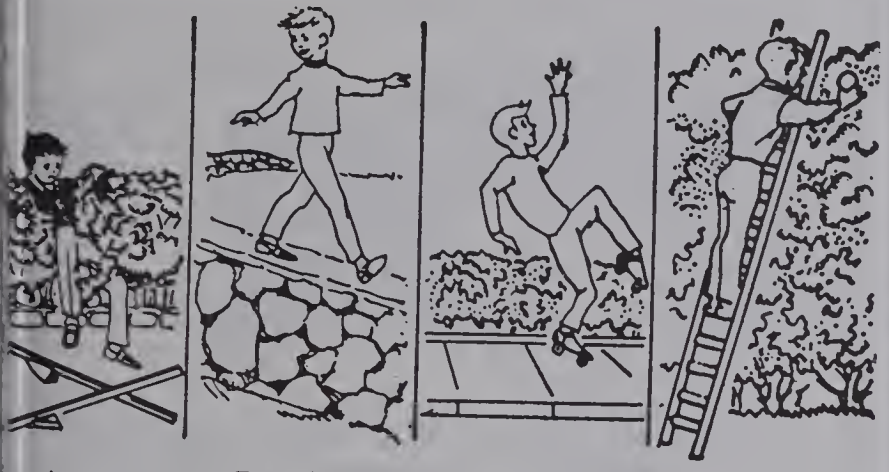
34. The earliest kinds of money were valuable obj which could be carried around and traded very eas Shells, precious stones, and even salt were early, sim kinds of money. Now we use valuable metals and make them into disks or coins. Which is an early f of money?



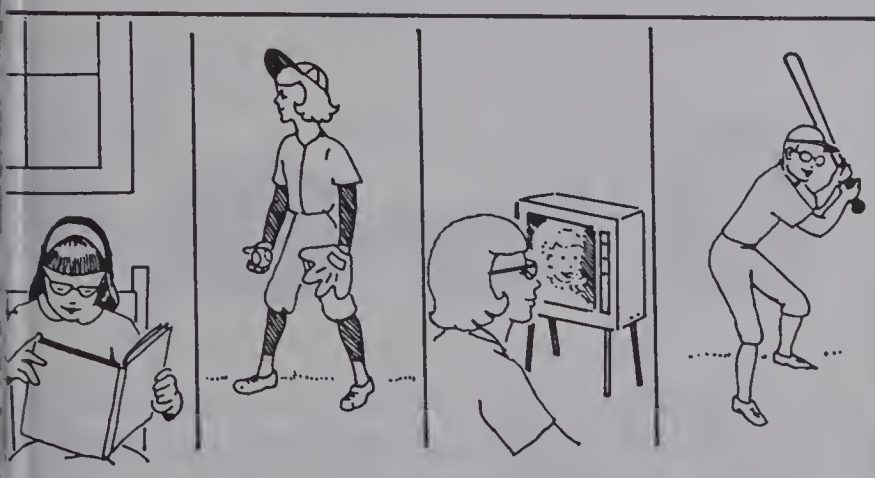
Look at a tree trunk that has been cut with a saw, l you will see tree rings. Rings close together mean t the tree didn't grow very much in the dry years. gs wide apart tell of fast growth in the wet years. u can tell how old the tree is by counting all the gs. Which boy is trying to find out the age of a tree?



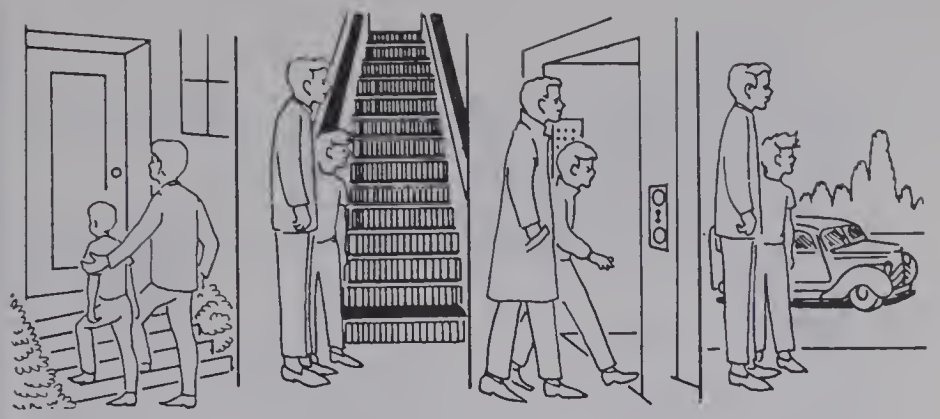
Her birthday present looked beautiful. It was pped in striped paper and there was a large bow in middle of the package. She could tell by the shape the package that the present must be something nd.



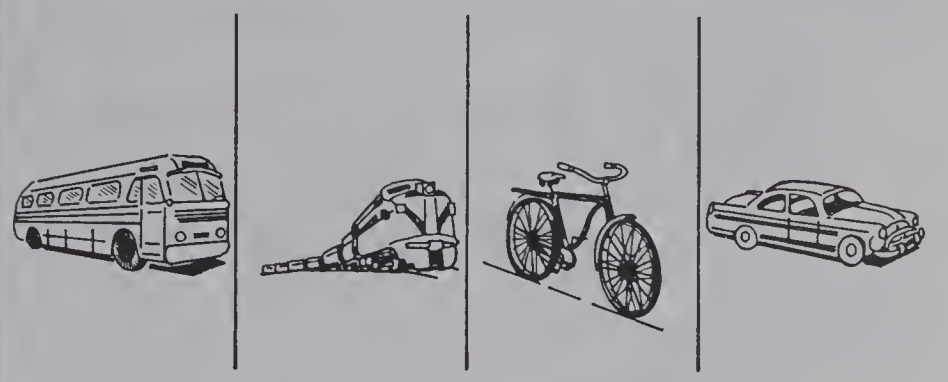
As soon as Joe finished making his stilts, he prac-d walking on them. The first time he fell, he wasn't t, but the second time he was scratched by the hedge.



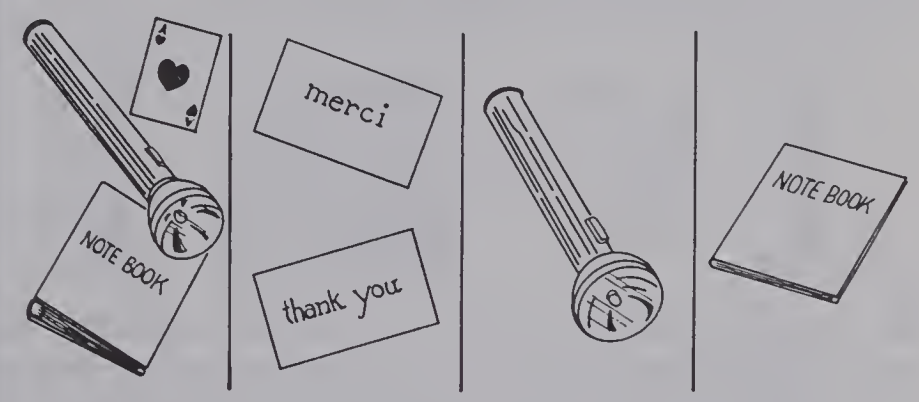
Dorothy needed to wear her glasses for reading, not when she pitched for the baseball team. Which ture shows where she did not need to wear her glasses?



23. Tom is making his first visit to a big city store. He is watching the moving stairs. His father is telling him that they are called escalators and that he should hold the handrail when he rides.



24. Our new neighbors have four boys. Ronnie, the youngest, goes to school by bus. Mike and Kim, the twins, ride their bicycles to the new junior high. Ben, the oldest, goes away to college. How does Kim go to school?

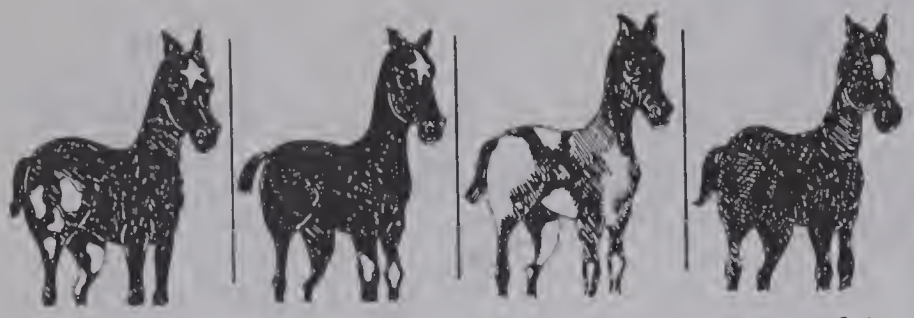


25. When you study another language, you may use cards to help you learn new words. They are called "flash cards." On one side is the word in English. On the other side the word is in the foreign language.

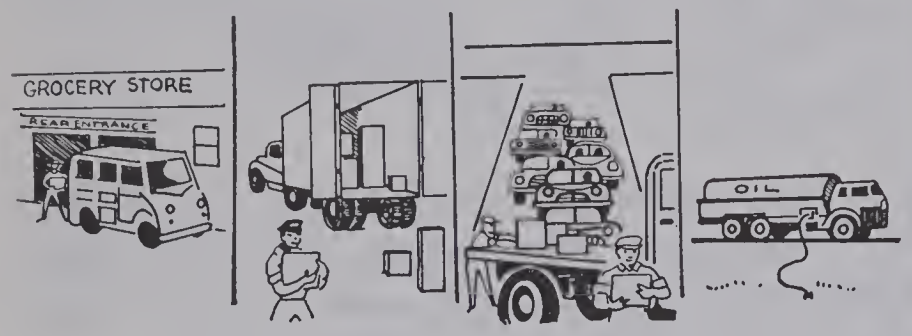


26. There are many different kinds of rocks. Some are sharp-edged. Some have been worn smooth by water. Some are hard, and some are soft and crumble easily into sand. Which rock has been worn smooth by water?

TURN THE PAGE



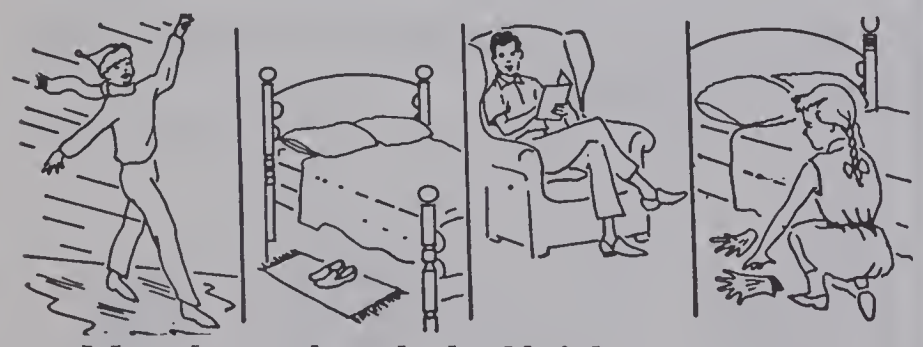
11. It was a black colt, all black except for a white star on its forehead and a little white mark on each front leg. The family decided to call it Star.



12. The men were unloading the truck. It was a busy street and the traffic was heavy. Cars were stopped and their drivers were waiting.



13. The candy that he was eating was peppermint. It was the end of the candy cane that he had found in his Christmas stocking.



14. Mary knew that she had left her slippers either beside her bed or in her closet. Where did she find them?



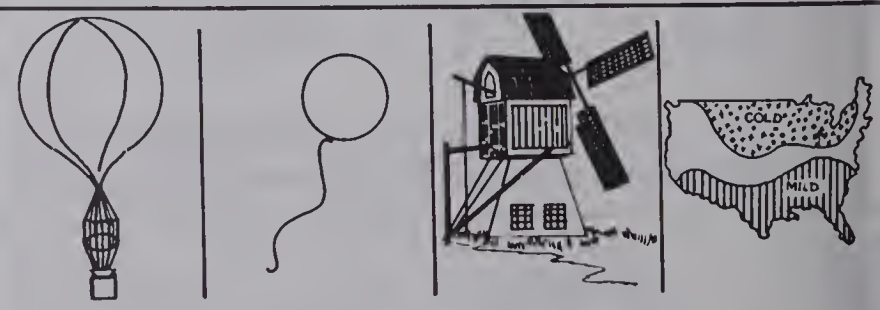
15. Every time they go to camp, they stop for lunch a Lindy's roadside place. They like to sit at the counte and they always have hamburgers and milkshakes.



16. The children were discussing fire escapes. Mar said her home was in an apartment building and the fi escapes were iron stairs which went up each side of th building. Andy said the fire escapes in his one-stor house were the doors and windows. Mark the buildin in which Mary lives.



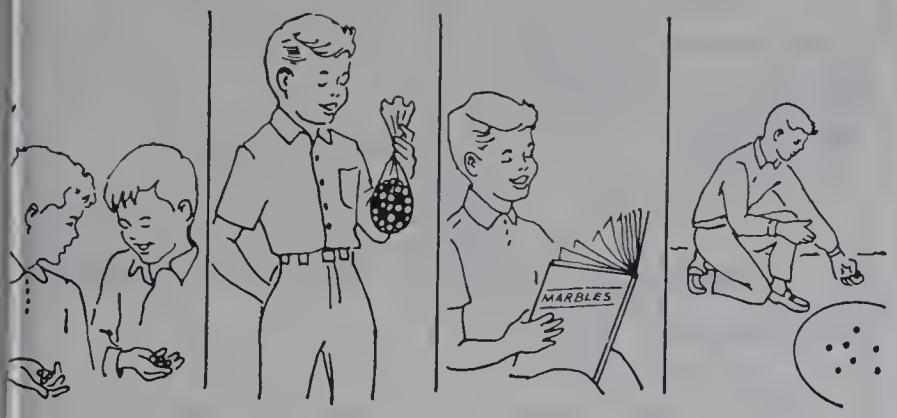
17. Did you know that the children from the villa had a party out at Dr. Morey's barn last night? He ha suggested that they dress like famous people from th past. Was David lucky! He found an old army unifor in Uncle Ted's attic. It belonged to a soldier in th Revolutionary War. How was David dressed?



18. Huge balloons with baskets under them are us by weathermen. The baskets carry instruments whi record wind speed and direction, temperature, a moisture high up in the air. The information the instruments give is used to predict weather on t ground. What is used to get weather information the upper air?

Comprehension

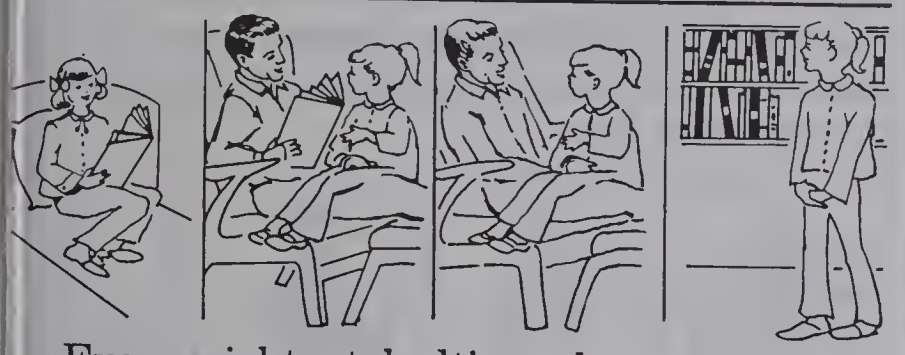
TART HERE



Which is the boy who is shooting marbles?



The nurse is taking the splinter out of Betty's ot.



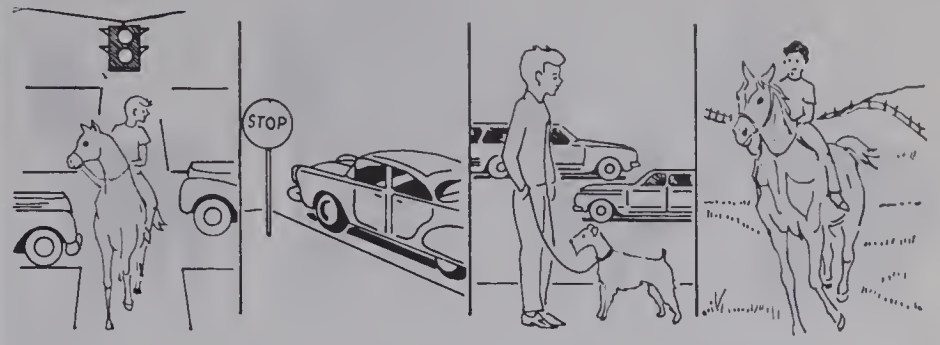
Every night at bedtime she sat with her ther in an armchair and listened while he read other chapter to her.



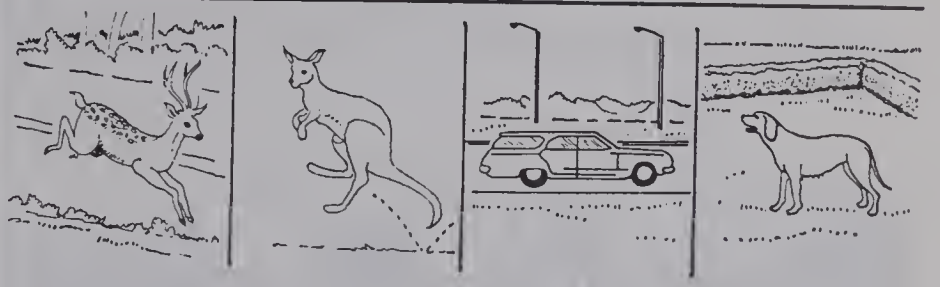
It was very cooling, on a hot summer day, sit in the tree swing and drink ice-cold lemonade.



After their swim, the scouts sat around the mpfire and sang. One boy played a mouth organ d two others kept time with sticks.



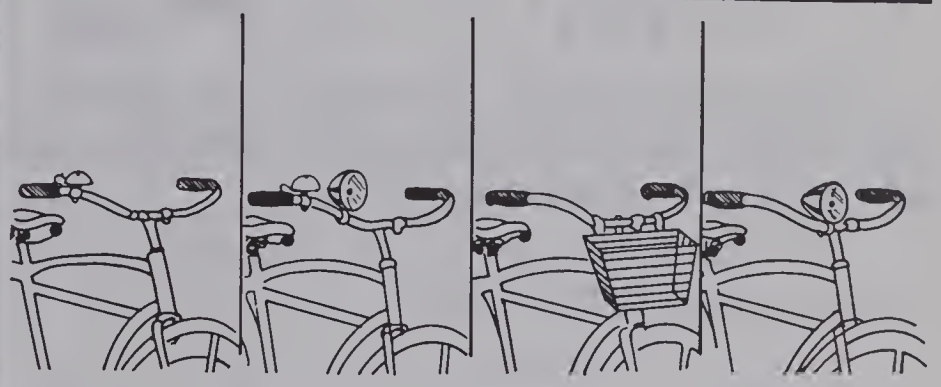
6. The light changed, the cars going north and south stopped, and the boy on horseback started across the highway.



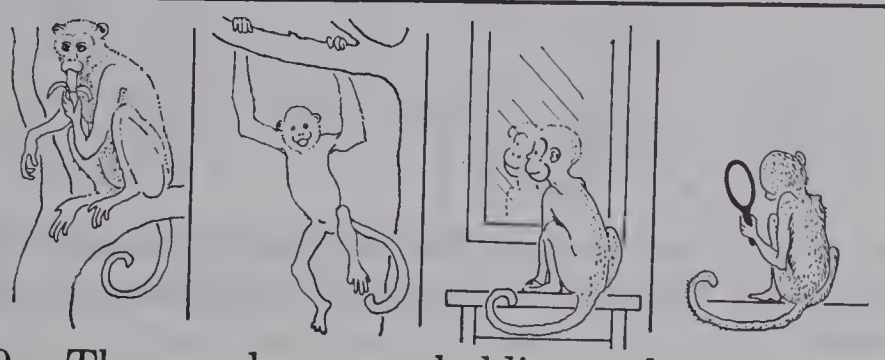
7. If you live near the woods, you may see deer in the evenings. They wander into back yards, along roads, and even into towns. You can watch them jump quickly away if they see you.



8. Because they were going to be late for dinner, Jack wanted to telephone his mother. He stopped at a telephone booth by the highway.



9. He put the new spotlight near the bell on the handle bar of his bike.



10. The monkey was holding a hand mirror. Every time he looked at himself in it, he put his head to one side and looked puzzled.

TURN THE PAGE

B29955